

**SOCIO-ECONOMIC SURVEY  
OF  
SMALLHOLDER FARMING SYSTEMS IN SOLOMON ISLANDS**

**SOUTH AUKI  
MALAITA PROVINCE**

**Agricultural Economics Section  
Rural Services Project  
Ministry of Agriculture and Lands  
Solomon Islands**

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## Abbreviations and Units of Measure

AES	Agricultural Economics Section (RSP)
CEMA	Commodities Exporting and Marketing Authority
DCRS	Dodo Creek Research Station
LDA	Livestock Development Authority
MAL	Ministry of Agriculture and Lands
PBME	Project Beneficiary Monitoring and Evaluation (RSP)
RDC	Rural Development Centre (RSP)
RSP	Rural Services Project
km	kilometre = 1,000 m
ha	hectare = 10,000 sq m
m	metre
MT	metric tonne = 1,000 kg
SI\$	Solomon Islands Dollar

## Acknowledgements

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E. C. Mackey  
Agricultural Economist

Agricultural Economics Section  
Rural Services Project  
Ministry of Agriculture and Lands  
Solomon Islands



## Chapter: 1

### INTRODUCTION

1.1 The Solomon Islands comprise a double chain of islands extending in a north-west south-east direction over 860km of the south-west Pacific between latitudes  $5^{\circ}$ - $12^{\circ}$  S and longitudes  $155^{\circ}$ - $170^{\circ}$  E. The islands lie directly along a major line of crustal weakness traversing the western Pacific and are the surface expressions of fault-bounded blocks and troughs originating in a zone of geologically intense activity. Warping and block movement are the most significant geomorphic processes responsible for the elevation of land to its present altitude, with marine sediments occurring on some of the highest ranges. Such processes continue spasmodically and raised reefs at various heights occur in many parts of the country, as does intense faulting. Earthquakes are frequent and often initiate land movements in ground already close to shearing point such as saturated soil at the heads of steeply incised gullies, resulting in debris slides among the high ridges (10).

1.2 Solomon Islands lies well within the geographical tropics in an oceanic area where two contrasting trade winds meet, a low-pressure belt of ascending air known as the "inter-tropical convergence zone" (ITCZ). In this zone warm and humid air masses drawn from equatorial regions meet relatively cool and dry sub-tropical air derived from the south-east. From about March to November the islands experience steady, shallow, south-easterly winds. During November and December unsettled weather is likely as the ITCZ moves south over the islands, from which follows steady north-westerly winds. March and April are again unsettled as the ITCZ returns northwards until the south-easterly trade winds become re-established. Cyclonic disturbances may be generated, particularly around December and April when the convergence of the two air streams is strongest. Weather is varied, both temporally and spatially, but is characterised by continually high average temperatures and humidity. Most land areas have a mean annual rainfall of 3,000-5,000mm with variations depending on latitude and orientation to prevailing winds. Temperatures are more uniform, at around  $26^{\circ}$  C in the lowlands, and never reach extremes which would restrict plant growth. Night time humidity exceeds 90%. This may fall to 60% on clear sunny days, or remain close to saturation point during cyclonic conditions (10).

1.3 The islands are rugged, with a predominance of ridge-valley landscapes and high relief. Undulating rolling landscapes have a limited distribution and extensive fluvial plains are uncommon. Chemical weathering is intense under conditions of continuously high temperature and moisture, however, soil depths are not generally great. Most hill areas have slopes exceeding 12-15° and commonly reach 35-55° among the mountain ridges. Continual soil wash and creep and periodic mass movements effectively keep pace with rock weathering. Only on stable flatter sites do deep profiles develop. The islands for the most part are covered in dense forest, some fire disclimax grassland in parts of Guadalcanal<sup>(10)</sup> and Florida Islands, and land cleared or cultivated.

1.4 The population of Solomon Islands from the 1986 census was 285,176, with an annual growth rate of 3.5%. The land area of 28,370sq km gives a low overall population density of 10 persons per sq km. Settlements are mostly along the coastal margins so that in some parts of the country population densities are high.

1.5 The population distribution of Solomon Islands is summarised in diagram 1.1 and key socio-economic data are presented in table 1.1

1.6 There is a considerable variation between land area and population among the provinces. While Western Province accounts for 33% of the national land area it contains only 19% of the population. The West is characterised by low population density compared to provinces such as Central, Malaita and Temotu. Although Temotu contains 5% of the national population it also accounts for only 3% of the national land area, and therefore has a relatively high mean population density. Land area in Solomon Islands is summarised in diagram 1.2.

Table: 1.1

## SOLOMON ISLANDS KEY DATA

Province	I	Western	Ysabel	Central	Guadalcanal	Honiara	I
POPULATION							
1986 population	I	55,250	14,616	18,457	49,831	30,413	I
annual growth rate	I	3.0	3.2	2.9	4.3	6.8	I
% national population	I	19	5	6	17	11	I
peri-urban population	I	3,710	1,901	1,622		30,413	I
% peri-urban	I	7	13	9	38		I
number of households	I	7,942	2,362	3,079	8,072	4,317	I
LAND AREA							
land area (sq km)	I	9,312	4,136	1,286	5,336	22	I
% land area	I	33	15	5	19	0	I
population density/sq km	I	6	4	14	9	1,382	I
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SIS'000)							
revenue	I	443	173	191	281	1,033	I
grants	I	2,556	634	623	1,247	704	I
current expenditure	I	3,504	849	750	1,431	1,561	I
capital expenditure	I	200	58	88	192	177	I
net revenue (negative)	I	(705)	(100)	(24)	(96)	(2)	I

Province	I	Malaita	Makira	Temotu	I	Total	I
POPULATION							
1986 population	I	80,032	21,796	14,781	I	285,176	I
annual growth rate	I	2.7	3.6	2.8	I	3.5	I
% national population	I	28	8	5	I	100	I
peri-urban population	I	3,252	2,588	1,295	I	44,781	I
% peri-urban	I	4	12	9	I	16	I
number of households	I	12,417	3,278	2,375	I	43,842	I
LAND AREA							
land area (sq km)	I	4,225	3,188	865	I	28,370	I
% land area	I	15	11	3	I	100	I
population density/sq km	I	19	7	17	I	10	I
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SIS'000)							
revenue	I	339	485	160	I	3,103	I
grants	I	1,891	1,095	445	I	9,195	I
current expenditure	I	2,190	1,472	615	I	12,371	I
capital expenditure	I	331	600	0	I	1,646	I
net revenue (negative)	I	(291)	(492)	(10)	I	(1,719)	I

Source: Statistics Office Statistical Bulletin 15/87 "Provincial Statistics"

Population data revised from Statistics Office Statistical Bulletin 3/88 "Solomon Islands Population Census"

## POPULATION COMPOSITION

% by province

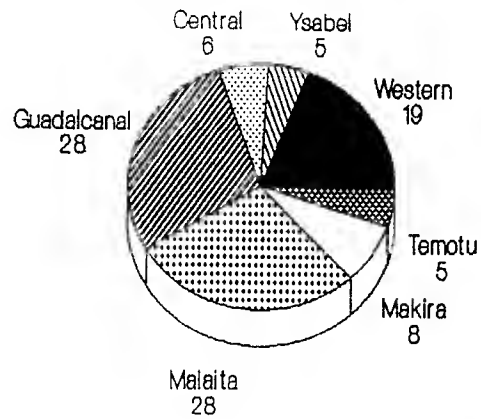


Diagram: 1.1

## LAND AREA

% by province

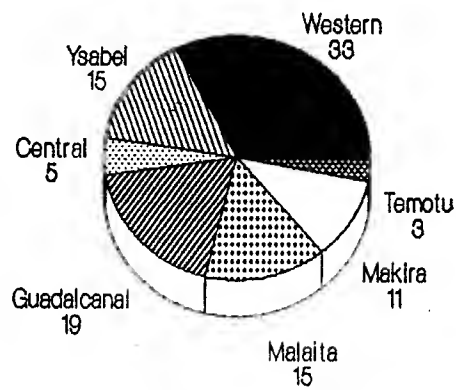


Diagram: 1.2

1.7 While a provincial comparison presents a broad indication of population densities throughout the country, differences within provinces are of significance to agricultural policy. With improvements in communications and administrative links there has been a general migration to the coastal margins where travel and marketing are easier, and where services such as schooling and health are more readily available. The highland interior tends to be sparsely populated in comparison.

1.8 While the overall population density is low, in some areas a growing population pressure is causing concern. Traditional farming systems based on forest fallow may be sustained under conditions of low pressure, but run into soil fertility and related problems when fallow periods are reduced and cropping intensified. Conversely, there are sparsely populated areas of agricultural potential where communications and services are poorly developed. The Rural Services Project is developing facilities in areas of high agricultural potential, providing marketing and transport infrastructure, agricultural and training services, and extending the coverage of adaptive research. These provide new opportunities for agricultural development.

1.9 The capacity of government to implement development programmes is to a large extent determined by funds and resources available. Diagram 1.3 summarises provincial government revenue and expenditure in 1987. Nationally there was a deficit of SI\$1.7 million arising through over expenditure in all provinces. Provincial finance is characterised by a low revenue earning capacity, being nationally about one third of the level of central government grants. Revenue and grants are expended almost entirely on basic operating costs, although these remain severely constrained and under-funded. There are little or no funds for development, and investment amounted to only 12% of total expenditure in 1987.

1.10 Agriculture accounted for 42% of export earnings in 1985<sup>(11)</sup>, although this has dropped from the much higher level of 87% in 1960. It is the major employment activity in the country and the source of livelihood for the majority of the population.

## GOVERNMENT FINANCE

### SI\$'000 by province (1987)

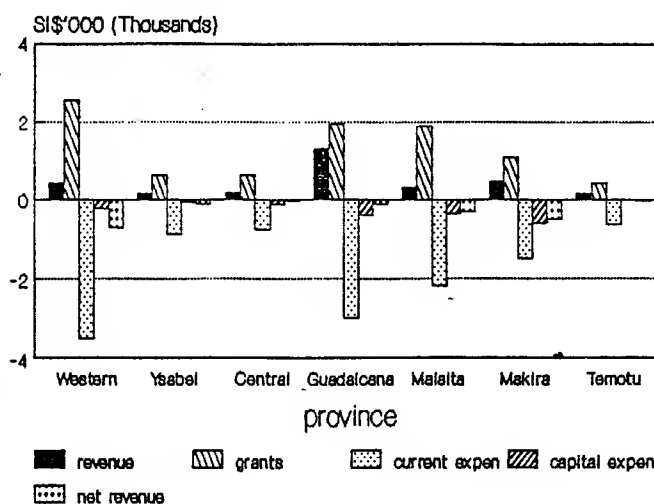


Diagram: 1.3

1.11 Despite various studies undertaken in the past, there is little hard socio-economic data on smallholder farming systems which would assist agricultural policy makers, trainers, extension workers and researchers in the planning, implementation and evaluation of development activities. A national sample survey of agriculture was conducted in 1974-75<sup>(5)</sup>, but these data are no longer able to satisfy information requirements.

1.12 The Agricultural Economics Section (AES) was established under the Rural Services Project (RSP) inter alia in order to generate statistical information on smallholder production systems for the quantification of constraints to agricultural development and the devising of appropriate agricultural research programmes. The present study is part of a national survey programme to generate detailed base-line data on smallholder farming systems.

1.13 Since September 1987 AES has conducted a series of farming systems surveys in selected sites throughout the country, such as in the immediate areas of influence of Rural Development Centres or in other areas of special agricultural interest. It is intended that the findings of the survey will find application in the evaluation of development activities, and will assist in the assessment of changes taking place in Solomon Islands agriculture and the formulation of development strategies. The background and justification for the survey programme are documented in the AES Inception Report of 1987<sup>(20)</sup>. Methodologies are described in the Agricultural Economics Field Survey Manual<sup>(21)</sup> and related documents produced by AES.

1.14 The South Auki survey was conducted at the request of Malaita Province, being an important area of root and fruit crop production for the urban centres of Auki and Honiara. Of particular interest was the importance of pineapple growing in the area. Accordingly the survey was undertaken among the coastal villages between Ura and Aisisi to the south of Auki and adjacent to the predominantly fishing villages of Langalanga Lagoon. Field work was conducted from November to December 1988 and it was intended to cover a sample of 40 rural households. Regrettably, repeated administrative and logistical problems were encountered which proved to be beyond the influence of the Agricultural Economics Section. These delayed the survey in progress and, despite the best efforts and good will of the Section, the survey was eventually terminated with only 26 households covered. Two stage systematic random sampling was guided by the Statistics Office based on equal probability of household selection, with accessibility taken into account in the definition of the sample frame. Villages were listed from the 1986 population census and selected by systematic random sampling. A pre-determined number of households within each village (or cluster of small villages) were then selected by simple random sampling. Maps of the survey area are presented in diagrams 1.4 and 1.5.











1.15 The survey is designed to investigate the structure and dynamics of smallholder crop and management systems. Of particular importance in the socio-economics of smallholder agriculture is the allocation of labour, since few cash inputs are applied and little wage labour is employed.

1.16 All cultivated areas, including cropped and cleared land, are measured by tape and compass to an error tolerance of 5%. Crop areas are computed and checked in the field by programmable calculator. Data are processed in "dBASE III Plus" databases and analysed through "SPSS/PC+". Raw output is transferred to "Lotus 123 v2" spreadsheets for tabulation and secondary processing. Text tables are incorporated into "Wordstar Professional v4" and graphics are edited in "Harvard Presentation Graphics".

1.17 The Agricultural Economics Programme is sponsored under the Rural Services Project of the Ministry of Agriculture and Lands which is co-financed by the Government of Solomon Islands and ADB/IDA/IFAD. Data processing and the presentation of results has been made possible by the generosity of the Government of New Zealand through its Miscellaneous Technical Assistance Programme. This has overcome a primary constraint to work of this kind in the Ministry of Agriculture and Lands through the provision of computing hardware.

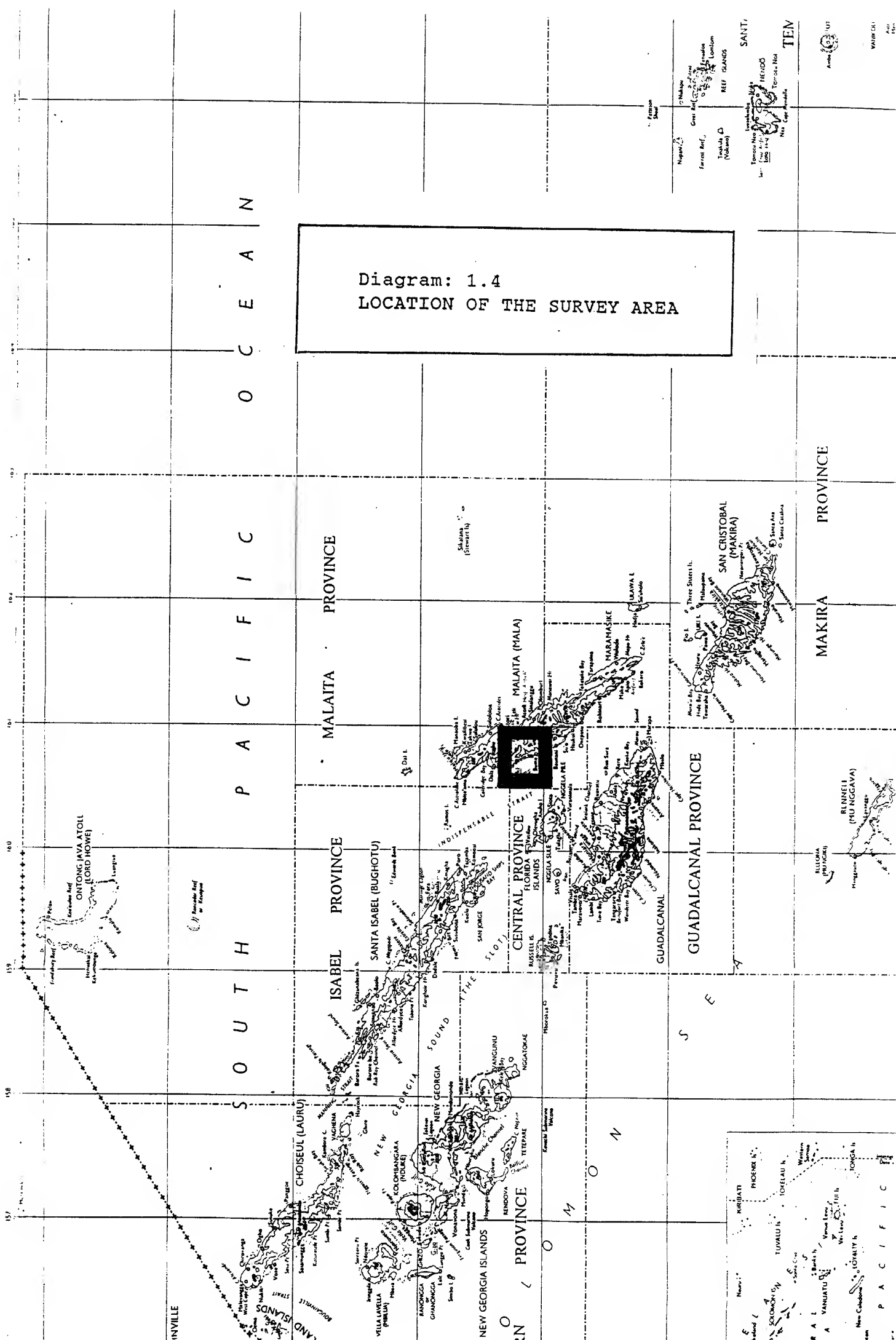


Diagram: 1.4  
LOCATION OF THE SURVEY AREA

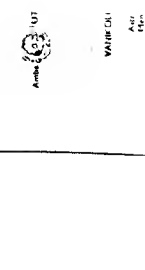
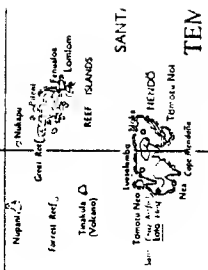
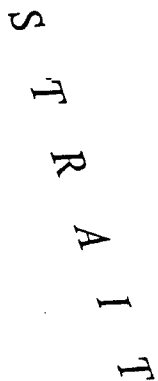


Diagram: 1.5  
SURVEY AREA



## **Chapter: 2**

### **SUMMARY AND MAIN FINDINGS**

#### **Household Composition**

2.1 The mean household size in the survey area is 6.54, comprised of 3.10 males to 3.44 females, a ratio of 1:1.11 males to females.

2.2 In the sample of 26 households the available labour composition of rural households in the survey area is 48% male and 52% female, a ratio of 1.65male:1.81female out of a total of 3.46 adult equivalent labour units per household.

#### **Income Earning Activities**

2.3 Agricultural income earning activities in the survey area are predominantly the sale of food crops and cocoa, and there is a high level of urban or service type employment. 39% of sampled households earn income from food crop sales and 8% earn income from minor cash crops, notably pineapple. There were no livestock sales encountered among sampled farmers. 12% of households earn income from fishing.

2.4 35% of households earn income from cocoa but only 4% of households earn income from copra.

2.5 35 of households earn income from a profession, in teaching and government service but also in a variety of other professions. 15% of sampled households earn income from cooperative shops. 15% of households run a business of some sort and 19% of households have a skilled trade.

#### **Extension and Mass Media**

2.6 68% of households listen to agricultural programmes on the radio. Simple written materials may be appropriate in extension since 96% of households have at least one member with some reading and writing ability.

2.7 31% of households are visited by agricultural extension workers, whether government or non-government, at least once per year or occasionally, and 19% of farmers have attended an agricultural training course.

### Livestock

2.8 There is a low level of commercialism in livestock management where the most important livestock are pigs and chickens. 11% of sampled farmers have cattle, with a mean herd size of 3.33.

2.9 84% of farmers keep pigs with a mean herd size of 2.32 among owners. 4% of farmers (one farmer) keep goats with a herd size of 6.00. Chickens are kept by 62% of households with a mean flock size of 10.31 among owners. 8% of farmers have ducks, with a mean flock size of 2.00.

### Holding Size Distribution

2.10 The mean holding size in terms of area farmed is 0.851ha but the holding size distribution is moderately skewed in that 50% of farmers have holdings of less than 0.5ha.

2.11 While holdings are on the whole small, inequality in holding size is due to a high proportion of farmers with very small holdings without coconuts and a few relatively larger holdings which account for a substantial proportion of the cropped area. Tree crop holdings tend to be larger than non-tree cropping holdings, with a mean size of 1.359ha and represent 46% of farmers. Conversely non-tree cropping farmers have a mean holding size of 0.416ha and represent 54% of sampled farmers.

2.12 The mean food crop area among all farmers is 0.353ha and the mean tree crop area among tree cropping farmers is 1.081ha.



### Labour Density

2.13 The mean labour availability is 3.46 adult equivalent labour units per farming household, resulting in a mean labour density of 4.07 labour units per hectare. There is no apparent association between labour availability and holding size but labour density per unit area falls rapidly from 28.47 labour units per hectare on holdings of less than 0.25ha in size to 0.94 labour units per hectare on holdings of 3 - 5ha in size. On non-tree cropping holdings the mean labour density is 8.57 labour units per hectare compared with 2.47 labour units per hectare on tree-crop holdings. Land availability, rather than labour availability, is the major limitation.

### Cropping Patterns

2.14 The average holding size is 0.86ha, however, a distinction is made between farmers with tree crops and those with no tree crops. Of households with tree crops the mean holding size is 1.36ha, of which 1.08ha is under tree crops and 0.28ha is food crops. In contrast non-tree crop farmers have a mean holding size of 0.41ha under food crops. Despite the small size of holdings smallholder cropping patterns are complex and diverse, with 11 dominant crops recorded and a total of 71 distinct mixtures.

### Coconuts and Cocoa

2.15 Maintenance standards in the survey area are high, with most plots brushed at least to shoulder height. 26% of plots undercropped (ie new plantings in food gardens), 47% are brushed to ground level, 21% are brushed to shoulder height and only 5% have a ground cover of secondary bush. In the survey the coconut variety is local tall. 27% are less than eight years of age, 18% are in the age band 9-16 years and 55% are 17-40 years of age.

2.16 21% of cocoa plots are less than three years of age, 21% are in the age band 3-5 years and 58% are 6-25 years of age. 29% of cocoa stands are under coconut shade while 64% are under natural shade and 7% are under natural shade but with additional planted shade.

### Fallow

2.17 Fallow in Solomon Islands farming systems is necessary for the maintenance of soil fertility, particularly for the replenishment of potassium in ash following burning. Shifting cultivation has other valuable characteristics, not least its phytosanitary qualities. The fallow period is an indicator of land pressure, and possible fertility and pest problems associated with intensive cultivation. On food gardens where it is known, there is a fallow period of 3.4 years, but 33% have a fallow longer than memory. Root crops are typically grown over 2 to 4 harvests before reverting to fallow.

2.18 38% of all gardens have a fallow of primary or secondary forest extending over 41% of the farmed area. Only 4% of the food gardens are cut from primary forest, representing an insignificant area. 12% of tree gardens are cut from primary forest on 24% of the tree crop area. Such results suggest that the area for expansion in the survey area is very limited and that cropping is becoming intensive.

2.19 In the survey there was no application of any type of fertiliser encountered. In one case a pesticide of unknown identification was applied to a sweet potato plot.

### Landform

2.20 65% of tree gardens representing 53% of the tree garden area are on lowland sites, with 35% of gardens on 47% of the tree garden area on upland sites of varying steepness. 24% of food crop gardens representing 22% of the food garden area are on lowland sites, while 76% of gardens representing 72% of the food garden area are on upland sites.

2.21 The mean slope is 6 degrees, with 61% of plots representing 60% of the cropped area on land of less than 5 degrees slope. Only 9% of gardens on 20% of the cropped area are on slopes of greater than 10 degrees. No conservation practices or alley cropping were encountered in the survey.

2.22 The mean time taken to reach gardens is .288 hours or about 17 minutes, with a maximum time of 2 hours. The largest gardens tend to be closest to the household. The mean time taken to reach tree crop gardens is .194 hours and the mean time taken to reach food gardens is .313 hours.

### Adverse Factors Affecting Production

2.23 60% of gardens representing 43% of the cultivated area have no apparent site limitations. Poor soil and site factors are regarded as constraints on 10% of gardens (5% of area); pests and disease are a problem on 29% of gardens (19% of area); weeds are a problem on 15% of gardens affecting 10% of the cultivated area.

### Crop Yields

2.24 Production data from the farming systems survey need to be reinforced with further yield studies to be undertaken by AES in 1989 and beyond. Indicative yields derived from secondary sources are presented in chapter 14.

2.25 In the survey the following yields were obtained:

#### Yield data from the farming systems survey

	<u># obs</u>	<u>kg/ha</u>
Copra	1	173
Cocoa (green beans)	7	150

## Labour

2.26 75% of gardens on 59% of the farmed area have no important constraints, due to a high proportion of very small holdings and a small overall mean holding size. The dominant constraints are on tree crops, and the dominant constraint is of inputs and cash rather than labour or distance of gardens from the household. A summary of constraints expressed as percentages of gardens by each crop type [and in brackets as the corresponding % area] is as follows:

limitation	<----- garden type ----->					
	tree crops		short term cash crops		food crops	
No limitation	64	[46]	33	[50]	84	[84]
Lack of labour	12	[24]	17	[ ]		
Lack of inputs	30	[39]	50	[50]		
Garden too far	6	[15]		[ ]	16	[16]

2.27 Labour expenditure on the average holding is summarised in table 2.1 - presented firstly by crop (aggregating all operations), and secondly by operation (aggregating all crops).

2.28 Overall men provide 24% of labour and women provide 74%, with 3% of farm labour accounted for by hired labour. There are 382 work days per year required on an "average" holding of which 90 are provided by men, 282 by women and 10 by hired labour. The average adult man in the household spends 55 days working on the holding and the average adult woman spends 156 days.

Table: 2.1  
SUMMARY OF LABOUR INPUT

	<----- work days per year ----->					<- % contribution ->			labour cost (SIS)
	<----- per holding ----->				per ha	men	women	paid	
i) By Crop	men	women	paid	total	average				
Cleared Land	1	1		2		50	50		1
Cocoa	19	12	1	32		59	38	3	6
Cabbage									
Vegetable					682				
Fruit Crops	34	32	7	73	512	47	44	10	21
Sweet Potato	28	218	2	248	1439	11	88	1	5
Taro	3	7		10	1997	30	70		
Yam					541				
Pana	3	2		5	382	60	40		1
Cassava	2	10		12	1502	17	83		
All Crops	90	282	10	382		24	74	3	34
ii) By Operation									
Land Clearance	16	20	5	41		39	49	12	17
Cultivation	18	12	1	31		58	39	3	3
Planting	19	17		36		53	47		
Tree Crops Establishment									
Tree Crops Maintenance	5	10	4	19		26	53	21	14
First Weeding	5	20		25		20	80		
Second Weeding	4	22		26		15	85		
Third Weeding	13			13		100			
Harvesting	10	181		191		5	95		
All Operations	90	282	10	382		24	74	3	34
Available labour units	:1.65	1.81							
Days per unit labour	: 55	156	10						

2.29 Cocoa accounts for 8% of the holding labour budget. Sweet potato accounts for 65% and pineapple accounts for 19%. Men and women perform most operations but women provide most of the labour, especially on harvesting. Of the annual labour budget of 382 days, land clearance accounts for 11% of labour expended, cultivation accounts for 8%, planting 9%, establishment and maintenance 5%, weeding or brushing 17% and harvesting 50%.

### Cash Crop Processing

2.30 Copra manufacture requires 25 work days per annum to produce 137kg copra, or one work day per 6kg copra produced. 10 work days are spent on picking and shelling the nuts which account for 39% of the total production time. Firewood collection takes 2 days or 8% of the time; and drying, bagging and transport take 13 days or 53% of the time.

2.31 From an annual production of 137kg valued at the prevailing price of 33 cents per kilo the gross return is SI\$45. Inputs costs from bags and twine amount to SI\$2.04. The net income is SI\$43 which, at a requirement of 25 household labour days, represents a net return to labour of SI\$1.75 per household work day.

2.32 In the processing of cocoa 67 family work days were expended in the production of 1,480kg cocoa green beans. At the prevailing price of SI\$0.70 per kilo green beans provides a net return of SI\$1,036, representing a return to labour of SI\$15 per family day worked.

### Marketing

2.33 Sale volumes and prices are generally regarded as "average". Local market prices from Auki are listed below:

<u>crop/commodity</u>		<--- price SI\$ in 1988 --->							
		<u>at 25 May</u>		<u>at 15 October</u>					
sweet potato		.29	.31	.97	.38	.62			
taro	common			.50	.67				
	Hong Kong	.29		.32					
pana		.25	.32						
yam		.20	.23						
coconut	dry	.08		.13					
	green	.33		.27					
banana	sweet	.17		.25					
	cooking	.25		.43					
pumpkin		.20		.29					
melon				.71	.83				
pumpkin tips				.46					
taro leaf				.67					
paw paw				.31					
pineapple		.19		.36	.50	.38	.46	.50	.44
hibiscus cabbage		.15		.47	.67	.27			
chinese cabbage				.31					
capsicum pepper				1.00	4.00				
tomato				.33					
watercress				.29					
shallot				1.00					
snake bean				.40					
long bean		1.00							
wing bean		.40							
cucumber		.15							
peanuts		4.00		4.00	3.14				
mangrove fruits				.22					
sugar cane		.11							
ngali nut		.50		2.00					
betel nut		.50		2.00	2.00				
	leaf			3.00					
	stick			1.00					
tobacco				10.00					

2.34 Crop marketing is important in the survey area, with relatively high levels of income earned in comparison to other areas under study. The two major income earning crops are pineapple and cocoa and most marketing is conducted locally or in Auki, although about one third of pineapple sales are to Honiara. The main marketing problems are with pineapple where transport difficulties and consequent marketing risks and costs are important constraints.



## Chapter: 3

### HOUSEHOLD COMPOSITION

3.1 The analysis of household composition in the farming systems survey is to set production and management information in a social context and to establish labour availability. New demographic data are becoming available from the 1986 census and these provide background to survey results. Table 3.1 summarises some early results of the census<sup>(1)</sup>.

Table: 3.1  
POPULATION CHARACTERISTICS  
(from the 1986 census)

I Province	I Western	Ysabel	Central	Guadal	Honiara	Malaita	Makira	Tenotu	I Total	I
I 1986 population	I 55,250	14,616	18,457	49,831	30,413	80,032	21,796	14,781	I 285,176	I
I annual growth rate	I 3.0	3.2	2.9	4.3	6.8	2.7	3.6	2.8	I 3.5	I
I % national population	I 19	5	6	17	11	28	8	5	I 100	I
I peri-urban population	I 3,710	1,901	1,622		30,413	3,252	2,588	1,295	I 44,781	I
I % peri-urban	I 7	13	9	38		4	12	9	I 16	I
I males	I 29,202	7,329	9,850	26,251	17,293	39,605	11,174	7,268	I 147,972	I
I females	I 26,048	7,287	8,607	23,580	13,120	40,427	10,622	7,513	I 137,204	I
I sex-ratio	I 112	101	114	111	132	98	105	97	I 108	I
I number of households	I 7,942	2,362	3,079	8,072	4,317	12,417	3,278	2,375	I 43,842	I
I household size	I 6.96	6.19	5.99	6.17	7.04	6.45	6.65	6.22	I 6.50	I
I Age composition (%)	I								I	I
I 0 - 14	I 46.4	48.8	45.7	46.8	39.2	50.2	50.7	49.6	I 47.3	I
I 15 - 29	I 27.2	22	26	27.2	35.7	21.7	23.3	23.3	I 25.8	I
I 30 - 44	I 13.5	13.9	14.4	14	17.1	13.2	13.1	13.3	I 13.9	I
I 45 - 59	I 8	8.5	8.2	7.3	5.8	9.1	8.2	8.5	I 8.1	I
I 60 +	I 4.9	6.7	5.7	4.6	2.1	5.7	4.6	5.5	I 4.9	I

Source: Statistics Office Statistical Bulletin 3/88

3.2 In November 1986 the population of Solomon Islands was 285,176 with an annual growth rate of 3.5%. The national mean household size was 6.5, resulting in a total of 43,842 households, of which at least 84% are rural. Guadalcanal, Malaita and Western Provinces account for 77% of the national population.

3.3 The age composition of the Solomon Islands population is young with a wide based, tapering population pyramid. The "dependency ratio" (the number of persons under 15 years and over 60 years of age per 100 persons aged 15 to 59 years) is 109<sup>(2)</sup>.

3.4 The total fertility rate is 6.4 children per woman at the end of her child bearing age. The life expectancy at birth among males is 59.9 years, and among females is 61.4 years. Male infant mortality is 40 per thousand live births compared with a female infant mortality of 36 per thousand live births<sup>(2)</sup>.

3.5 In the census 40,046 persons attended school during 1986, although some disruption was caused by Cyclone Namu. Among all persons aged 5 years and over not attending school in 1986, 51% had no education. Primary school attendance spans a wide age range, but 20% of age group 10 to 24 never attended school.

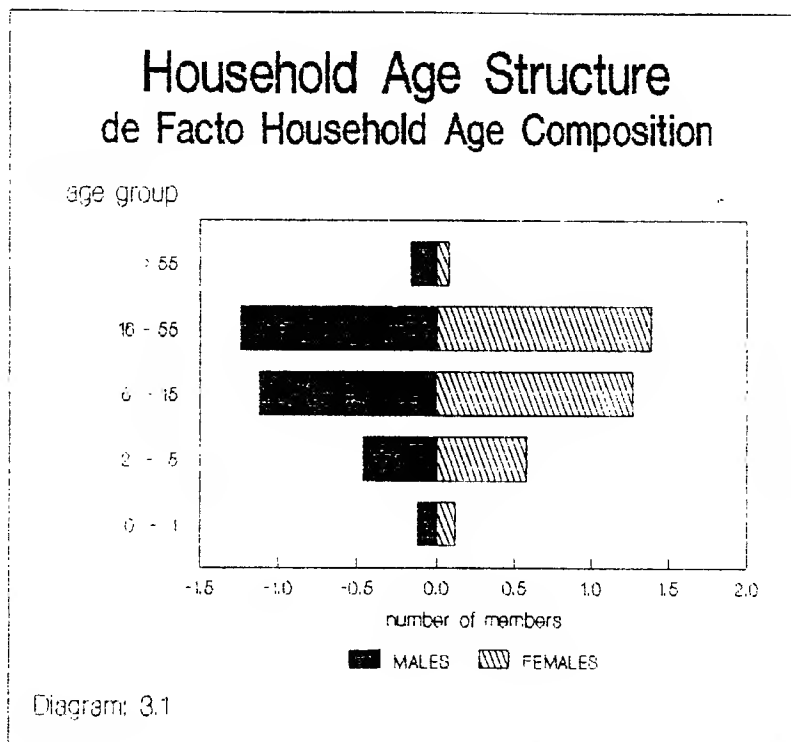
3.6 94.2% of the Solomon Islands population is Melanesian, 3.7% Polynesian and 2.1% other ethnic groups, but mainly Kiribati. 17% of the census population were residing in a province other than that of their birth, indicating a considerable level of internal migration. Onward movement is particularly strong from Malaita, resulting in net out-movement. This is true for provinces other than Central and Guadalcanal which experience a net in-movement. All provinces showed a net movement to Honiara.

3.7 Household composition results from the farming systems survey are summarised in table 3.2. Age categories are chosen to provide approximate conversion into "available labour units". The membership of a household often includes relatives and, less commonly, non-relatives (these are both referred to as "relatives" in the table). Both family and non-family members define the "de facto" household size which is the actual number of people residing in the household, and is illustrated in diagram 3.1. A second measure of household composition is the number of immediate family members (father, mother, sons and daughters) either living at home or living away. This is known as the "de jure" family size.

Table: 3.2  
HOUSEHOLD COMPOSITION

Mean Number of Household Members:

MALE					FEMALE				
living at HOME					living at HOME				
Head	Family	Relative	Family	AGE GROUP	Head	Family	Relative	Family	
0.12		0.04		> 55	0.08				
0.85	0.31	0.08	0.42	16 - 55	0.04	1.23	0.12	0.08	
	1.04	0.08	0.15	6 - 15		1.23	0.04	0.04	
	0.42	0.04		2 - 5		0.54	0.04		
	0.12		0.04	0 - 1		0.12			total
Category total:	0.97	1.89	0.24	0.61	0.04	3.20	0.20	0.12	7.27
Family at home:		2.86				3.24			6.10
De Facto total:			3.10				3.44		6.54
De Jure total :				3.47				3.36	6.83



3.8 In the survey area the average family size is 6.83. With 11% of family members living away from home, a household has on average 6.54 members, of which 6.10 are immediate family and the remainder relatives or others residing in the household. Of the family members living away 0.50 are in the economically active age group 16 - 55 and 0.23 are younger than 15 . Of 3.47 male family members 2.86 live at home, representing a net onward movement of 18% among male family members. This is not compensated for by non-family male household members, since there are 3.10 males in the household.

3.9 Of 3.36 female family members 3.24 live at home, representing an onward movement of 4% . This is more than compensated for by additional non-family female members living in the household since there are 3.44 female members of the household.

3.10 There is then an 11% net outward movement of males and a 2% net inward-movement of females. This results in a household gender composition of 3.10 male household members to 3.44 females, a ratio of 1:1.11 males to females.

3.11 Household composition is converted into "adult equivalent labour units" in table 3.3 according to factors employed by Bathgate<sup>(18)</sup> (although there are slight differences in age classes between the two studies). An average household of 3.46 labour units is made up of 1.65 male units and 1.81 female units, a ratio of 1:1.10 male to female labour units.

Table: 3.3

## HOUSEHOLD LABOUR AVAILABILITY

Mean number of members by age group:

<----- MALES ----->			I	AGE	I	<----- FEMALES ----->			<----- TOTAL ----->		
de Jure	de Facto	labour	I	GROUP	I	de Jure	de Facto	labour	de Jure	de Facto	labour
			I		I						
0.12	0.16	0.09	I	> 55	I	0.08	0.08	0.05	0.20	0.24	0.14
1.58	1.24	1.23	I	16 - 55	I	1.35	1.39	1.38	2.93	2.63	2.61
1.19	1.12	0.33	I	6 - 15	I	1.27	1.27	0.38	2.46	2.39	0.71
0.42	0.46		I	2 - 5	I	0.54	0.58		0.96	1.04	
0.16	0.12		I	0 - 1	I	0.12	0.12		0.28	0.24	
			I		I						
Total	3.47	3.10	1.65			3.36	3.44	1.81	6.83	6.54	3.46

Labour availability assumes the following conversion factors:

age class	factor
> 55	0.6
16 - 55	1.0
6 - 15	0.3
0 - 5	0.0

## Chapter: 4

### INCOME EARNING ACTIVITIES

4.1 2.5% of rural households in the country were enumerated in the 1982 Household Income and Expenditure Survey <sup>(3)</sup> conducted by the Statistics Office of the Ministry of Finance. Virtually all rural households had food gardens. 39% sold copra and 41% sold garden produce, with an average monthly income from sales of SI\$ 56. A summary of income earning activities according to the 1982 survey compared with the 1986 population census is presented in table 4.1.

Table: 4.1  
1982 INCOME AND EXPENDITURE SURVEY: SALES

activity	% households earning income	
	1982	1986
copra	39	29
coconut	18	
cocoa	0.38	9
betel nut	1.25	17
other cash crop	12	
garden produce	41	34
cattle		2
pigs		12
poultry		10
fish	24	17
crabs, lobster		4
beche de mer		12
shells	7	
carvings	4	
hand crafts	0.38	4
canoes		3
mats, baskets		10
thatch		4
houses		5
other sales	1.13	

Source: Statistics Office National Accounts Discussion Document No 2  
Statistics Office Bulletin 12/88

4.2 These figures show the importance of garden produce sales as an income earning activity, although the relative magnitude of earnings is not known. Copra is the major cash earning commodity, showing an apparent contraction in the proportion of rural sales. Cocoa sales have, in contrast, expanded.

4.3 In the 1982 survey 27% of rural households had at least one member in paid employment, from which the average monthly wage was SI\$103. 16% had their own business and 39% of households had a share in a cooperative (although it is stated that this result should be treated with caution). 10% of households held a loan, with an average monthly repayment of SI\$87, the majority with the Development Bank of Solomon Islands.

4.4 On average a household spent SI\$57 per month on goods and services of which 47%, or SI\$27, was on food. Less frequent expenditures amounted to SI\$5 per month.

4.5 Reported (cash and non-cash) income was SI\$147 compared to monthly expenditures of SI\$131. The average cash component of income amounted to SI\$86 per month compared with expenditures of SI\$74. The excess of 17% in income over expenditure was believed to be due to the underestimation of production costs rather than the true value of rural savings.

4.6 The 1986 census <sup>(2)</sup> found that 25% of the population aged 14 years and over was working for money (the week before the census enumeration), and about half of those also performed village work such as track clearing and church construction. About 80% of those not engaged in cash employment performed village work.

4.7 35% of males were engaged in cash employment compared with 13% of females. The 1982 Household Income and expenditure survey also states that "generally boys had a better chance of attending school than girls".

4.8 The rural economy is diverse, with a variety of farm and off-farm activities which contribute to household income. Results from the farming systems survey are presented in table 4.2. The table describes the proportion of households undertaking income earning activities in the survey area. Rural income and expenditure patterns are covered by other (non AES) surveys - planned or recently undertaken - and so the present survey does not investigate the relative importance of activities undertaken

in terms of income earned, except in Chapter 19 on marketing.

Table: 4.2

# INCOME EARNING ACTIVITIES

	(<---- % households ----> by activity		
	individual	group	summary of individual activities
Households Earning Income Over the Past Year From:			
COCONUTS			
Coconuts .....			
Copra .....	4	4	+
Coconuts and Copra .....			
Total	4		
COCOA			
Wet beans .....	35	35	+++++
Dry Beans .....			
Wet and Dry Beans .....			
Total	35		
OTHER CROPS			
Food Crops .....	39	39	+++++
Other Cash Crops .....	8	8	+++
Food and Cash Crops .....			
Livestock .....			
Food crops and Livestock .....			
Cash Crops and Livestock .....			
Food, Cash Crops and Livesock			
Total	46		
FISHING			
Fish .....	12	12	++++
Shellfish .....			
Fish and shellfish .....			
Crabs, etc .....			
Fish and Crabs .....			
Shellfish and Crabs .....			
Fish, Shellfish and Crabs ....			
Total	12		
LOGGING/MINING			
Logging .....			
Sawmill .....	8	8	+++
Logging and Sawmill .....			
Mining .....			
Logging and Mining .....			
Sawmill and Mining .....			
Logging, Sawmill and Mining ..			
Total	8		



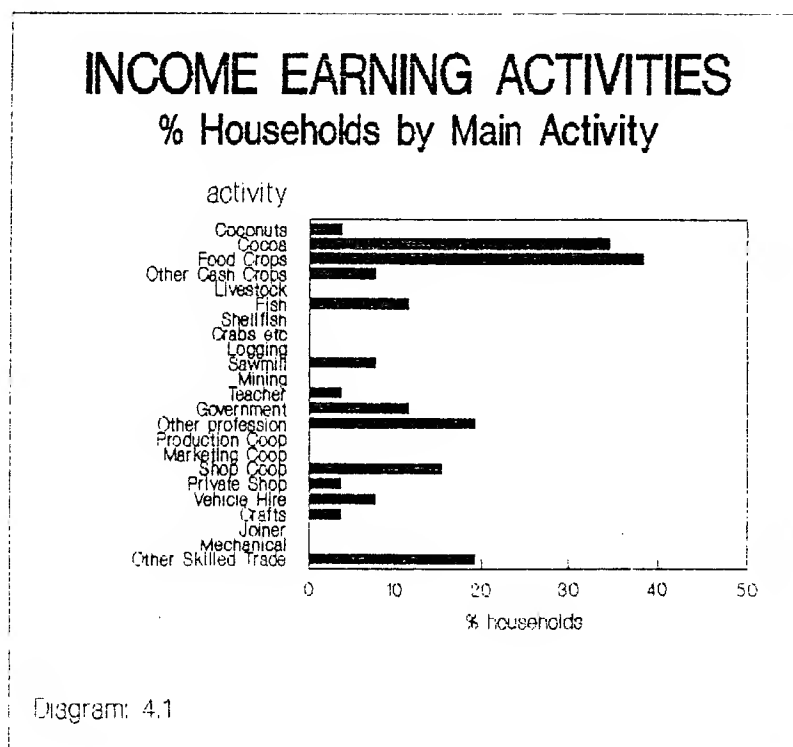
# INCOME EARNING ACTIVITIES (continued)

	(<---- % households ----> by activity		
	individual	group	summary of individual activities
PROFESSION			
Teacher .....	4	4	+
Government Employee .....	12	12	+++++
Other Profession *.....	19	19	+++++++
Total	35		
* includes Pastor, Area Constable and others			
COOPERATIVE			
Crop Production Cooperative ..			
Marketing Cooperative .....			
Crop and Marketing .....			
Cooperative Shop .....	15	15	++++++
Crop and Shop .....			
Marketing and Shop .....			
Crop, Marketing and Shop .....			
Total	15		
BUSINESS			
Private shop .....	4	4	+
Vehicle Hire .....	8	8	+++
Shop and Vehicle .....			
Crafts .....	4	4	+
Shop and Crafts .....			
Vehicle and Crafts .....			
Shop, Vehicle and Crafts .....			
Total	15		
SKILLED TRADE			
Joiner/housebuilder .....			
Mechanical Trade .....			
Joiner and Mechanical .....			
Other Skilled Trade .....	19	19	++++++
Joiner and Other .....			
Mechanical and Other .....			
Joiner, Mechanical and Other .			
Total	19		

4.9 In the table are two columns, entitled "individual" and "group". Individual activities distinguish between combinations of activities - treating for instance "food crops" (only), "livestock" (only) and both "food crops and livestock" as three distinct activities. The percentages of households for individual activities are additive, and are shown as a "total" for each set of related activities in the table.

4.10 Under group activities - all occurrences of "food crops" and all occurrences of "livestock" are summarised under the two main headings, since "livestock" and "food crops and livestock" are both livestock activities. "Group" activities represent an alternative summary for the data set, and are non additive.

4.11 To the right of table 4.2 is a histogram summary of individual activities. Diagram 4.1 provides a visual summary of grouped activities.



4.12 Agricultural income earning activities in the survey area are predominantly the sale of food crops and cocoa, and there is a high level of urban or service type employment. 39% of sampled households earn income from food crop sales and 8% earn income from minor cash crops, but there are no livestock sales encountered. 12% of households earn income from fishing.

4.13 35% of households earn income from cocoa but only 4% of households earn income from copra. In the project area there appears to have been a move away from copra production as a cash enterprise, firstly to cattle and more recently to cocoa.

4.14 35% of households earn income from a profession, in teaching and government service but also in a variety of other professions. 15% of sampled households earn income from cooperative shops. 15% of households run a business of some sort and 19% of households have a skilled trade, in enterprises such as chain saw operation, boat building and making shell money.

## Chapter: 5

### EXTENSION AND MASS MEDIA

5.1 Table 5.1 summarises the penetration of mass media and extension in the survey area.

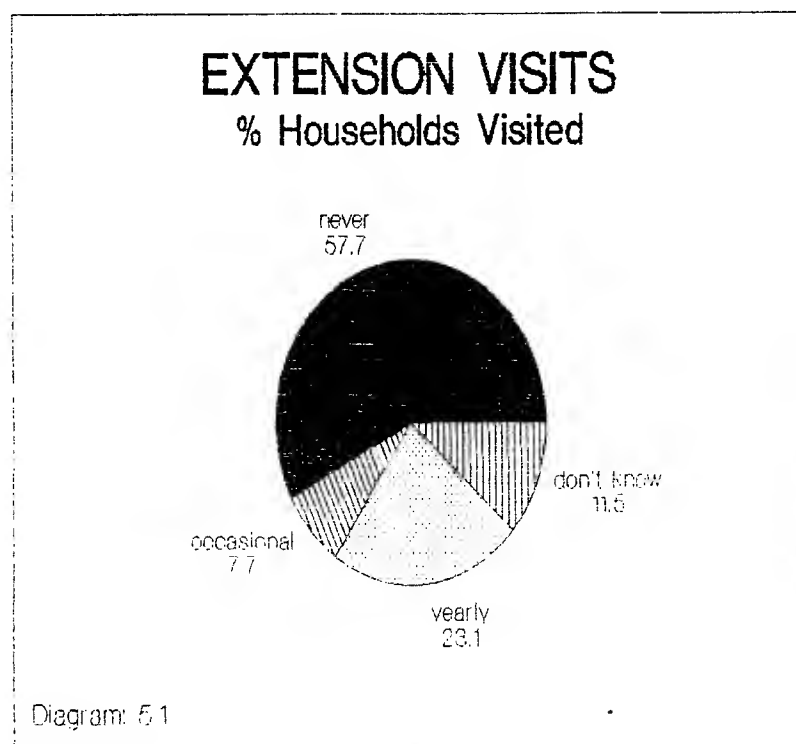
Table: 5.1  
EXTENSION AND MASS MEDIA

	% households	summary
i) Households Listening to Agricultural Programmes on the Radio:		
Never listen .....	42	+++++++
Listen weekly .....	23	++++
" monthly .....	8	+
" occasionally .....	27	+++++
Total	100	
ii) Households with Members who can Read and Write:		
Not able to read or write .....	4	.
Able to read .....		
" write .....		
" read and write .....	96	+++++
	100	
iii) Households Visited by (any type of) Extension Worker:		
Never been visited .....	58	+++++
Visited very occasionally .....	8	+
" once per year .....	23	++++
" " " 6 months .....		
" " " 3 months .....		
" " " month .....		
" " " week .....		
Don't know .....	12	++
	100	
iv) Households in which Members have Attended Training:		
Never attended training .....	81	+++++
Attended village meeting .....		
" day course at training centre .....	8	+
" village meeting and day course .....		
" residential course .....	8	+
" village meeting and residential course .....		
" day and residential course .....	4	.
" village meeting, day and residential course ...		
	100	

5.2 Travel and communication are difficult in Solomon Islands, with scattered islands of low population densities. Radio offers a means of transmitting information throughout the country, albeit one-way, and in a medium which makes few demands on literacy. In the survey 68% of households listen to agricultural programmes on the radio, although only about half of this on a regular basis. The communication of agricultural and other development information by radio may be extended further by word of mouth.

5.3 The second part of the table shows the proportion of households in which at least one member is able to read or write. According to these results 96% of households have at least one member with some reading and writing skills. The survey was unable to verify the level of skills or to substantiate this finding objectively, but the result suggests that simple written materials are an appropriate extension medium. In more general terms, pictural materials would be popular together with simple text and annotation.

5.4 The frequency of extension visits is investigated in the third part of the table, and is illustrated in diagram 5.1.



5.5 Extension in the present study refers to any agricultural worker in government extension, research, NGOs or other organisations. 31% of households have been visited by extension, but only infrequently, and 19% have received some form of agricultural training.

## Chapter: 6

### LIVESTOCK

6.1 Livestock, particularly small stock such as pigs and chickens, are an important feature of smallholder agriculture in Solomon Islands.

6.2 The number of cattle in the 1985 census was 19,750 - a fall of 13.1% from 1984 due largely to destocking in the plantation sector. Overall the national herd was 22% below its peak of 1978, with an average annual fall of 3.4%<sup>(4)</sup>.

6.3 The smallholder sector accounted for 7,612 cattle, 39% of the national herd, showing a decline of 4.1% from the 1984 census. The distribution of cattle throughout the country is shown in table 6.1.

Table: 6.1  
CATTLE DISTRIBUTION IN 1985

Province	total cattle	% distribution
Western	4,841	25
Ysabel	1,110	6
Central	2,081	10
Guadalcanal	6,292	32
Malaita	3,810	19
Makira	1,462	7
Temotu	217	1
Total	19,750	100

Source: Statistics Office, 1985 Cattle Census

6.4 In the 1982 Income and Expenditure Survey<sup>(3)</sup> it was found that 37% of households owned pigs, 30% owned chickens, but only 8% owned cattle. The provincial breakdown is shown in table 6.2.

6.5 According to the 1986 Population Census<sup>(2)</sup> 2% of households earned income from cattle, 12% earned income from pigs and 10% earned income from poultry.

Table: 6.2  
LIVESTOCK DISTRIBUTION IN 1982

Province	% households owning		
	cattle	pigs	chickens
Western	2	19	24
Ysabel	42	25	47
Central		28	7
Guadalcanal	2	63	41
Malaita	9	35	28
Makira	10	69	63
Temotu		40	4
Total	8	37	30

Source: Statistics Office, 1982 HH Income and Expenditure Survey

6.6 8% of households earned income from livestock (table 4.2) sales.

6.7 Table 6.3 summarises livestock ownership in the survey area, and is divided into three columns. The first, entitled "ownership %", specifies the percentage of households which own livestock. The middle two columns show mean stock held: firstly among livestock owning households (owners); and secondly as an average of all farmers in the survey area (both owners and non-owners). To the right of the table is a histogram summary of ownership based on the mean among all farmers.

6.8 The table is divided horizontally into three main parts. The first part specifies stock numbers kept predominantly for home use, but which may include occasional sales. The second part specifies stock numbers where livestock comprise an income earning enterprise. The third part is the overall mean of livestock ownership irrespective of type of enterprise. (Note that overall mean ownership figures are derived from the original data and may not be obtained from summation of the table entries above).

6.9 At the foot of the table is a component on novel livestock enterprises, such as bees, butterflies and crocodile farming, however, these were not encountered in the survey.



Table: 6.3  
LIVESTOCK

Livestock Ownership:

	ownership %	<-- mean ownership among --> owners all farmers		summary all farmers
i) Home Use				
Cattle .....	8	3.00	0.23	.
Pigs .....	84	2.32	1.96	++++++
Goats .....				
Chickens .....	62	10.31	6.35	+++++
Ducks .....	8	2.00	0.15	.
Horses .....				
ii) Commercial				
Cattle .....	4	4.00	0.15	.
Pigs .....				
Goats .....	4	6.00	0.23	.
Chickens .....				
Ducks .....				
Horses .....				
iii) Total				
Cattle .....	11	3.33	0.38	+
Pigs .....	84	2.32	1.96	++++++
Goats .....	4	6.00	0.23	.
Chickens .....	62	10.31	6.35	+++++
Ducks .....	8	2.00	0.15	.
Horses .....				
iv) Households Earning Income				
		<---- % households ----> by activity		
		individual	group	
Income from:				
1. Bees or honey .....				
2. Butterflies .....				
3. Bees and Butterflies .....				
4. Crocodiles .....				
5. Bees and crocodiles .....				
6. Butterflies and crocodiles .....				
7. Bees, butterflies and crocodiles ..				

6.10 There is generally a low level of commercialism in the management of livestock in the survey area. Cattle are felt to be costly and difficult to manage . 11% of sampled farmers had cattle, with a mean herd size of 3.33 head.

6.11 Pigs play an important role in the custom and life of rural households. They are kept mainly for ceremonial feasts, weddings and funerals, and other social gatherings. 84% of sampled farmers keep pigs with a mean herd size of 2.32 among owners. Pigs may be sold for cash but are generally sold for custom money/shell money for bride price. Pigs are generally kept in cages over the shoreline or in fenced paddocks in the bush. Both men and women look after the pigs, which are fed in the morning and evening on staples such as sweet potato, cassava, banana and scraps.

6.12 Goats are kept by 4% of sampled farmers, which is a herd of 6 held as a commercial enterprise.

6.13 Chickens are kept for sale and for family consumption. They are either housed using bush materials or are allowed to free range, requiring minimal management. Chickens are kept by 52% of sampled households with a mean flock size of 10.31 among owners. Ducks are also kept by 8% of households with a mean flock size of 2.

## Chapter: 7

### HOLDING SIZE DISTRIBUTION

7.1 Holding size distribution is of interest because it provides an understanding of the structure of agriculture and may help to explain constraints faced by farmers or response to services.

7.2 Table 7.1.i describes the holding size distribution of the survey area. Holdings are in general small and a high proportion of farmers have very small areas. With a mean holding size of 0.851ha, 50% of farmers have holdings smaller than 0.5ha. This can be seen in diagram 7.1 which shows that inequality in the holding size distribution arises largely because a high proportion of farmers fall in the very low holding size class of 0 to 0.25ha while a small proportion of farmers account for a disproportionate part of the farmed area.

7.3 The mean describes the "average" holding size and is of interest in that it provides a value for the "middle" of the data based on the spread of values, but it may be misleading when unbalanced extreme values occur. Another measure of central tendency is the median which is the "mid-point" in the data, the value of the middle item when the data are arranged in order. In a "normal distribution" the median and the mean coincide. The median in this case is 0.477ha which is appreciably lower than the mean holding size.

7.4 An indicator of variability is the range, which is derived from extremes in the data. The minimum area is 0.035ha and the maximum is 3.356ha, a fairly small range of 3.321ha.

7.5 The standard deviation is a measure of variation based on the extent to which values deviate from the mean. If the data are closely bunched the standard deviation is small, and if they are widely spread it is large. In a normal distribution 68% of values lie within 1 standard deviation on either side of the mean, and 95% within 2 standard deviations. In the survey results the mean of 0.851ha has a standard deviation of 0.929 and a coefficient of variation of 109% (the standard deviation expressed as a percentage of the mean).

7.6 Skewness is an index of symmetry in the data. A normal distribution is symmetrical about the mean, with a skewness coefficient of zero, whereas a skewed distribution has a longer "tail" on one side than the other. The present data have a skewness of 1.499 indicating only slightly positive skewness.

7.7 Kurtosis is the extent to which the data cluster around a central point. When this occurs the distribution appears "peaked". Positive values of kurtosis indicate that the distribution is more peaked than normal. In the present data set has a low coefficient of kurtosis of 1.747.

7.8 The indications are that there is inequality in holding size distribution, since a high proportion of farmers have very small holdings while a few have relatively large holdings. The holding size distribution may be viewed in standard form in diagram 7.2. The diagonal represents the holding size distribution for equality and the curve below represents the actual (cumulative) holding size distribution. The area between the diagonal and the curve is the "area of inequality". The larger the area of inequality, the more unequal the holding size distribution. This may be expressed as an index, called the "Gini coefficient", which is the area between the two lines expressed as a proportion of the area of the triangle below the diagonal. The Gini coefficient ranges from 0 (for perfect equality) to 1 (for perfect inequality). The Gini coefficient here is 0.538, indicating a moderately high degree of inequality.

Table: 7.1  
HOLDING SIZE DISTRIBUTION

i) All holdings and all crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % -----> holdings                      area		<-- cumulative % --> holdings                      area	
0 - .25	10	0.1324	1.32	38	6	38	6
.25 - .5	3	0.3886	1.17	12	5	50	11
.5 - .75	3	0.5774	1.73	12	8	62	19
.75 - 1	1	0.9625	0.96	4	4	65	23
1 - 1.25	3	1.1742	3.52	12	16	77	39
1.25 - 1.5	1	1.3567	1.36	4	6	81	45
1.5 - 1.75	1	1.5033	1.50	4	7	85	52
1.75 - 2	1	1.8516	1.85	4	8	88	61
2 - 2.5	1	2.2067	2.21	4	10	92	71
2.5 - 3						92	71
3 - 5	2	3.2553	6.51	8	29	100	100
5 - 10						100	100
10 - highest						100	100
<hr/>							
Total	26	0.8514	22.14	100	100		
<hr/>							
Mean	0.851			S.E. Mean		0.182	
Median	0.477			Coef. of Var %		109	
Std Dev	0.929			Variance		0.862	
Kurtosis	1.747			S.E. Kurtosis		0.887	
Skewness	1.499			S.E. Skewness		0.456	
Range	3.321			Minimum		0.035	
Maximum	3.356			Sum		22.136	
Gini	0.538						

Note that the main table is a frequency distribution of grouped intervals, while the statistics at the foot of the table describe the ungrouped data set.

## HOLDING SIZE DISTRIBUTION

all holdings - all crops

holding size (ha)

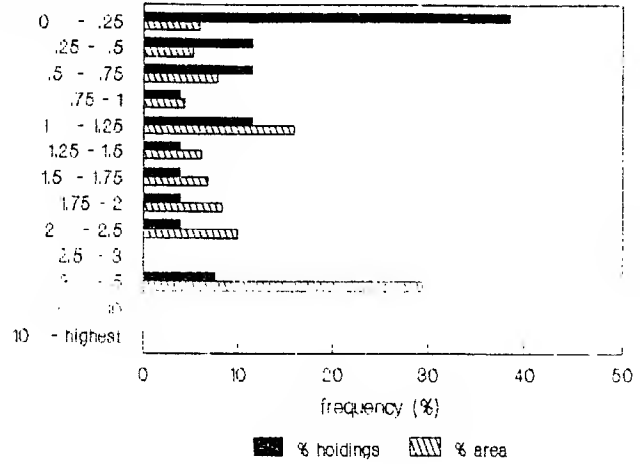


Diagram: 7.1

## LORENZ CURVE

all holdings - all crops

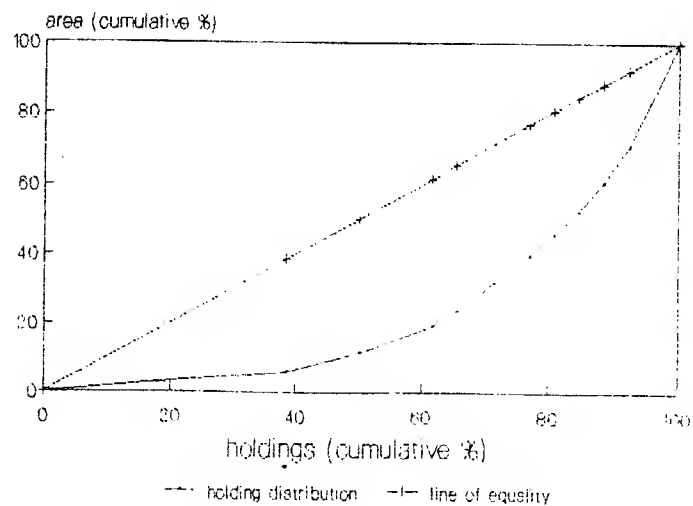


Diagram: 7.2

7.9 Table 8.1.ii shows the holding size distribution of only those farmers who have tree crops. The sample is reduced from 26 to 12, and so the stratum of farmers with tree crops represents 46% of farmers in the sample.

7.10 The mean holding size among tree cropping farmers is 1.359ha and the median is 1.041ha. The coefficient of skewness has dropped to 0.850 and kurtosis is slightly negative. The range remains wide, but the majority of very small holdings are excluded so that the distribution is less scattered, with a coefficient of variation of 80%.

ii) Holdings with tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % -----> holdings                      area		<-- cumulative % --> holdings                      area	
0 - .25	1	0.1236	0.12	8	1	8	1
.25 - .5	2	0.4081	0.82	17	5	25	6
.5 - .75	2	0.6080	1.22	17	7	42	13
.75 - 1	1	0.9625	0.96	8	6	50	19
1 - 1.25	1	1.1204	1.12	8	7	58	26
1.25 - 1.5						58	26
1.5 - 1.75	1	1.5033	1.50	8	9	67	35
1.75 - 2	1	1.8516	1.85	8	11	75	47
2 - 2.5	1	2.2067	2.21	8	14	83	60
2.5 - 3						83	60
3 - 5	2	3.2553	6.51	17	40	100	100
5 - 10						100	100
10 - highest						100	100
<hr/>							
Total	12	1.3592	16.31	100	100		
<hr/>							

Mean	1.359	S.E. Mean	0.313
Median	1.041	Coef. of Var %	80
Std Dev	1.083	Variance	1.172
Kurtosis	-0.412	S.E. Kurtosis	1.232
Skewness	0.850	S.E. Skewness	0.637
Range	3.232	Minimum	0.124
Maximum	3.356	Sum	16.311
Gini	0.418		

7.11 The new distribution of farmers with tree crops is illustrated in diagram 7.3, and its associated Lorenz curve in diagram 7.4. Inequalities have been slightly reduced by excluding the smaller holdings and the holding size distribution is more "normal" with a Gini coefficient of 0.418.

## LORENZ CURVE

### holdings with tree crops

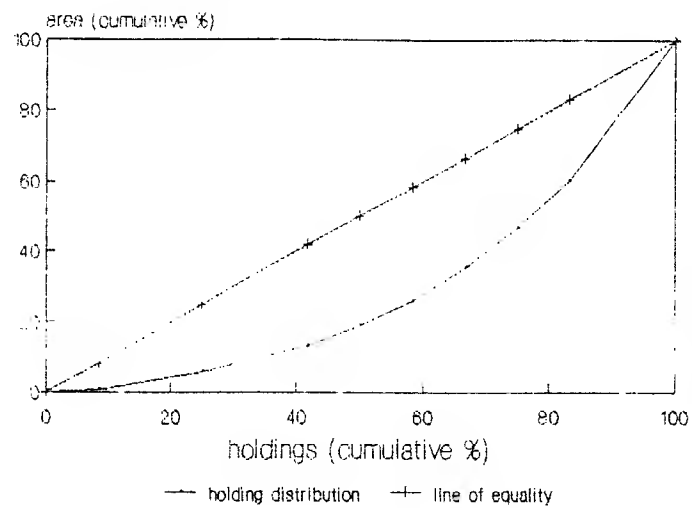


Diagram: 7.4

## HOLDING SIZE DISTRIBUTION

### holdings with tree crops

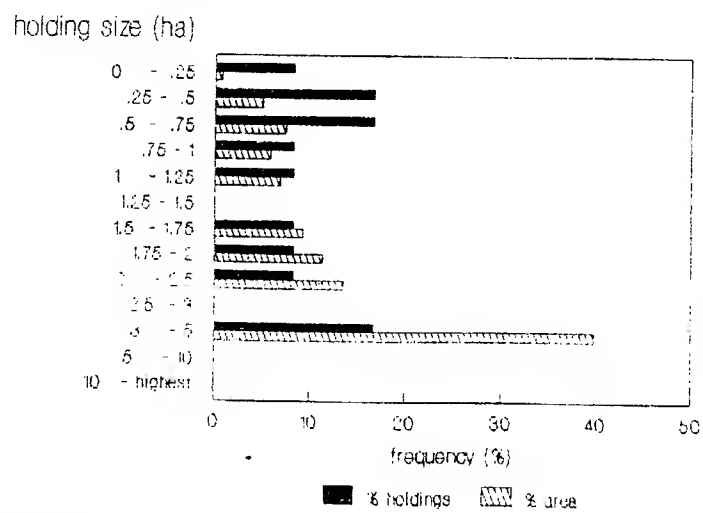


Diagram: 7.3



7.12 The corresponding stratum of farmers with no tree crops is shown in table 7.1.iii. 14 farmers, or 54% of the sample have no tree crops. The mean holding size is 0.416ha and the median is 0.219. The range is relatively wide because three farmers have holdings of greater than 1ha, but a high proportion of farmers again tend to have very small holdings. Skewness is 1.312 and kurtosis is 3.143. The distribution has a high coefficient of variation of 114%.

7.13 The holding size distribution is illustrated in diagram 7.5, and its associated Lorenz curve in diagram 7.6. Inequality is unusually high with a Gini coefficient of 0.542.

iii) Holdings without tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % -----> holdings                      area		<-- cumulative % --> holdings                      area	
0 - .1	4	0.0480	0.19	29	3	29	3
.1 - .2	3	0.1731	0.52	21	9	50	12
.2 - .3	2	0.2446	0.49	14	8	64	21
.3 - .4	1	0.3498	0.35	7	6	71	27
.4 - .5						71	27
.5 - .6	1	0.5164	0.52	7	9	79	35
.6 - .7						79	35
.7 - .8						79	35
.8 - .9						79	35
.9 - 1						79	35
1 - 1.5	3	1.2530	3.76	21	65	100	100
1.5 - 2						100	100
2 - highest						100	100
<hr/>							
Total	14	0.4161	5.83	100	100		
<hr/>							

Mean	0.416	S.E. Mean	0.127
Median	0.219	Coef. of Var %	114
Std Dev	0.473	Variance	0.224
Kurtosis	0.143	S.E. Kurtosis	1.154
Skewness	1.312	S.E. Skewness	0.597
Range	1.322	Minimum	0.035
Maximum	1.357	Sum	5.826
Gini	0.542		

Note the smaller size classes in this table with respect to previous tables.

## HOLDING SIZE DISTRIBUTION

### holdings without tree crops

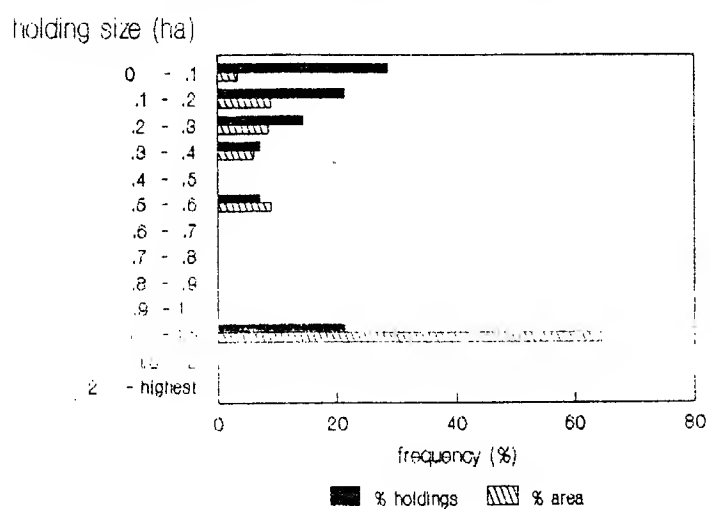


Diagram: 7.5

## LORENZ CURVE

### holdings without tree crops

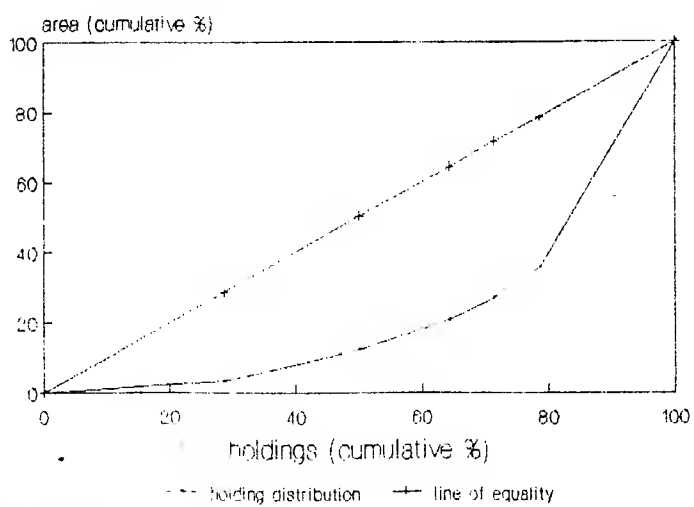


Diagram: 7.6

7.14 Table 7.1.iv describes the holding size distribution of all farmers, but excluding tree crop areas. The holding size distribution is illustrated in diagrams 7.7 and 7.8. These results are similar to those for non-tree crop farmers, indicating that subsistence cropping is similar among all farmers with a mean area of 0.353ha.

iv) All holdings - total area excluding tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % ----->		<-- cumulative % -->	
				holdings	area	holdings	area
0 - .1	4	0.0480	0.19	15	2	15	2
.1 - .2	7	0.1466	1.03	27	11	42	13
.2 - .3	5	0.2277	1.14	19	12	62	26
.3 - .4	3	0.3580	1.07	12	12	73	37
.4 - .5	2	0.4517	0.90	8	10	81	47
.5 - .6	2	0.5378	1.08	8	12	88	59
.6 - .7						88	59
.7 - .8						88	59
.8 - .9						88	59
.9 - 1						88	59
1 - 1.5	3	1.2530	3.76	12	41	100	100
1.5 - 2						100	100
2 - highest						100	100
<hr/>							
Total	26	0.3526	9.17	100	100		
<hr/>							
Mean	0.353			S.E. Mean		0.071	
Median	0.221			Coef. of Var %		103	
Std Dev	0.363			Variance		0.132	
Kurtosis	2.779			S.E. Kurtosis		0.887	
Skewness	1.868			S.E. Skewness		0.071	
Range	1.322			Minimum		0.035	
Maximum	1.357			Sum		9.169	
Gini	0.477						

## HOLDING SIZE DISTRIBUTION

all holdings excluding tree crops

holding size (ha)

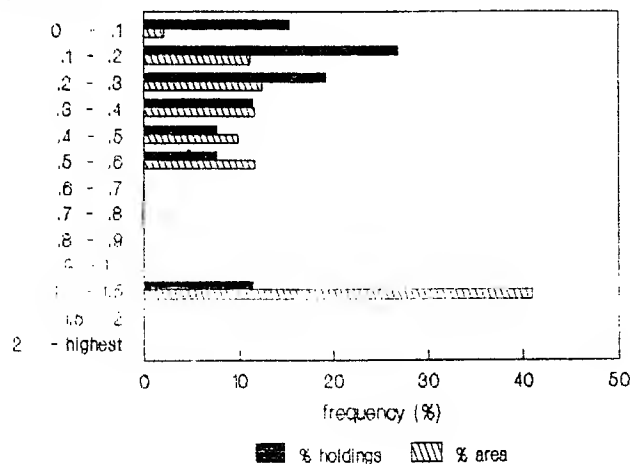


Diagram: 7.7

## LORENZ CURVE

all holdings excluding tree crops

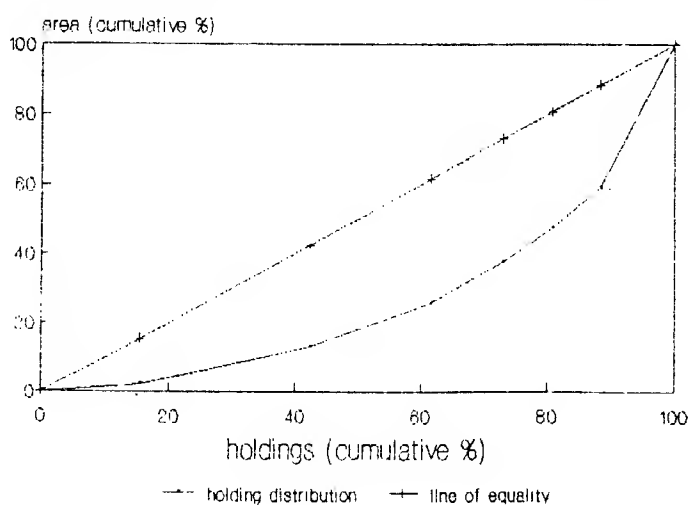


Diagram: 7.8

7.15 Table 7.1.v describes the size distribution of tree crop areas, illustrated in diagrams 7.9 and 7.10.

v) All holdings - total area of tree crops only

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<----- % ----->		<-- cumulative % -->	
				holdings	area	holdings	area
0 - .25	3	0.1602	0.48	25	4	25	4
.25 - .5	1	0.3551	0.36	8	3	33	6
.5 - .75	3	0.5734	1.72	25	13	58	20
.75 - 1						58	20
1 - 1.25	1	1.0066	1.01	8	8	67	27
1.25 - 1.5						67	27
1.5 - 1.75	1	1.6188	1.62	8	12	75	40
1.75 - 2	1	2.0000	2.00	8	15	83	55
2 - 2.5						83	55
2.5 - 3	2	2.8933	5.79	17	45	100	100
3 - 5						100	100
5 - 10						100	100
10 - highest						100	100
<hr/>							
Total	12	1.0807	12.97	100	100		
<hr/>							

Mean	1.081	S.E. Mean	0.296
Median	0.582	Coef. of Var %	95
Std Dev	1.027	Variance	1.055
Kurtosis	-0.428	S.E. Kurtosis	1.232
Skewness	0.977	S.E. Skewness	0.977
Range	2.964	Minimum	0.007
Maximum	2.971	Sum	12.968
Gini	0.483		

7.16 Indicators of variability are low indicating that variability in holding size is largely accounted for by a high proportion of very small holdings without tree crops.

## HOLDING SIZE DISTRIBUTION

all holdings - tree crops only

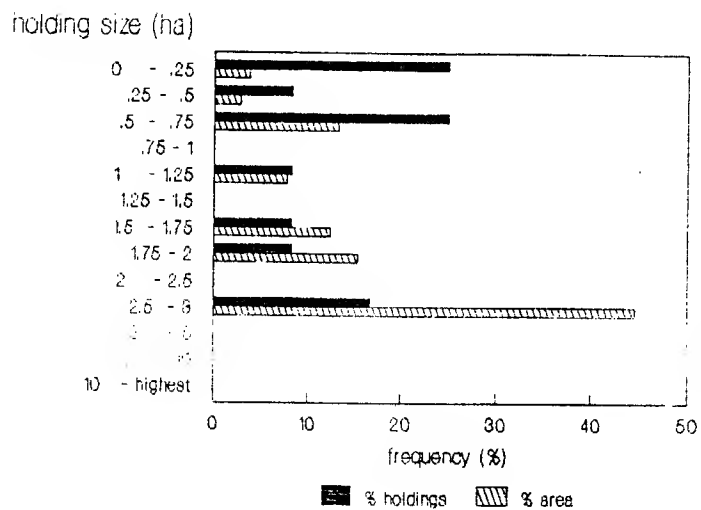


Diagram: 7.9

## LORENZ CURVE

all holdings - tree crops only

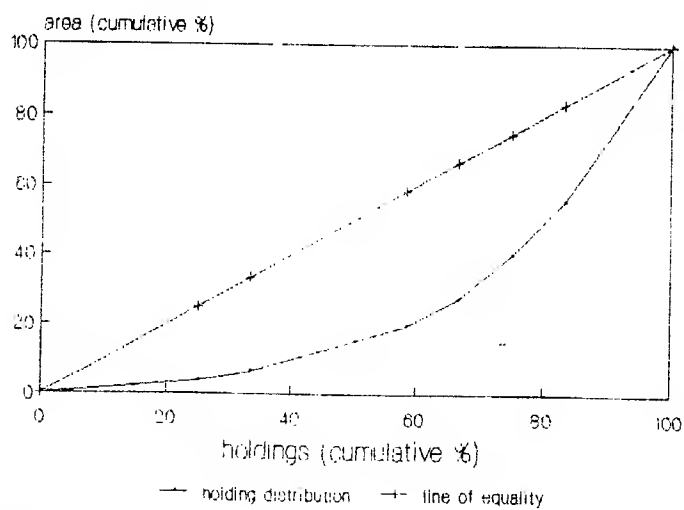


Diagram: 7.10

## Chapter: 8

### LABOUR DENSITY

8.1 According to Bathgate<sup>(18)</sup> "increments in the population of a household do not result in an expansion in the garden area. Instead, the garden area holds constant and ... the actual area per consumption and labour unit decreases ... Although there is a variation ... the average household ... tends to clear a fairly similar amount of land for gardens and plant a similar area of root crops". Bathgate postulates that there is no relationship between household size and food garden area. Larger family sizes are not then associated with larger holdings, and he attributes this to a tendency among subsistence producers to cultivate in excess of household requirements as insurance against crop failure.

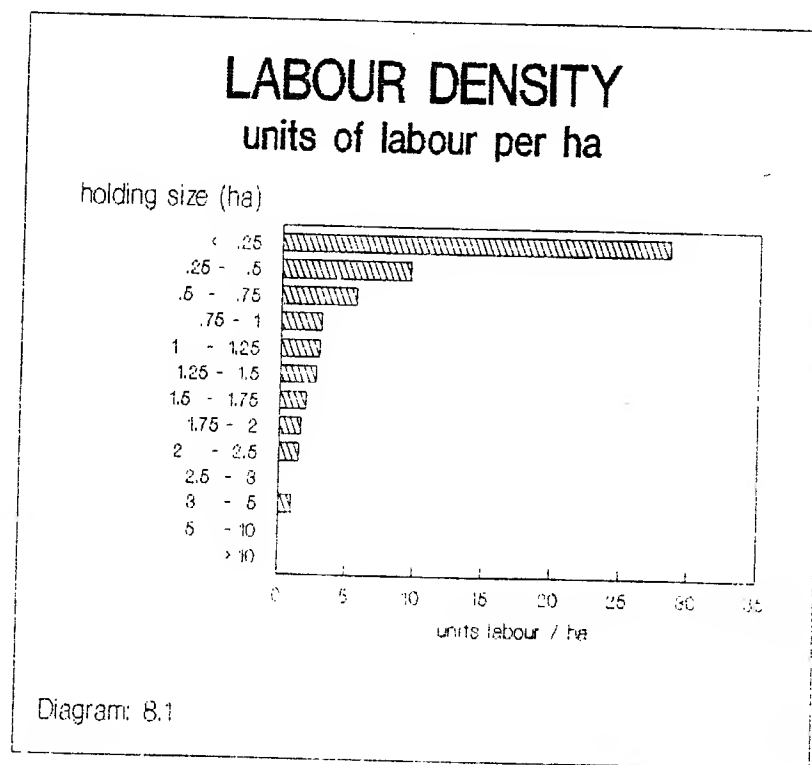
8.2 In the present survey the area of food crops is found to be relatively constant in comparison to a variable tree crop area. Table 8.1 shows the relationship between holding size and labour availability.

Table: 8.1  
LABOUR DENSITY - ALL HOLDINGS

holding size class (ha)	:	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	:	3.47	0.85	4.07	26
< .25	:	3.77	0.13	28.47	10
.25 - .5	:	3.70	0.39	9.52	3
.5 - .75	:	3.23	0.58	5.60	3
.75 - 1	:	2.90	0.96	3.01	1
1 - 1.25	:	3.37	1.17	2.87	3
1.25 - 1.5	:	3.60	1.36	2.65	1
1.5 - 1.75	:	2.90	1.50	1.93	1
1.75 - 2	:	2.90	1.85	1.57	1
2 - 2.5	:	3.20	2.21	1.45	1
2.5 - 3	:				
3 - 5	:	3.05	3.26	0.94	2
5 - 10	:				
> 10	:				

8.3 There is no apparent relationship between holding size and available labour. Results are in agreement with Bathgate's findings since labour density falls rapidly from 28.47 adult units per hectare for the smallest holding class (less than 0.25ha) to 0.94 units in the largest (3-5ha) class. Small holdings then have a very high labour density while the larger holdings have a low labour density, as seen in diagram 8.1.

8.4 Labour densities are high on small holdings and with a mean of 4.07 labour units per hectare, labour is unlikely to be seriously limiting.





8.5 Holdings without tree crops are shown in table 8.2.

Table: 8.2

LABOUR DENSITY - NON-TREE CROP HOLDINGS

holding size class (ha)	:	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	:	3.56	0.42	8.57	14
< .25	:	3.79	0.13	28.42	9
.25 - .5	:	3.00	0.35	8.58	1
.5 - .75	:	2.60	0.52	5.03	1
.75 - 1	:				
1 - 1.25	:	3.30	1.20	2.75	2
1.25 - 1.5	:	3.60	1.36	2.65	1
1.5 - 1.75	:				
1.75 - 2	:				
2 - 2.5	:				
2.5 - 3	:				
3 - 5	:				
5 - 10	:				
> 10	:				

8.6 The range of holding size is much smaller and the mean labour density is 8.54 labour units per hectare. The largest holdings of up to 1.5ha in size have a labour availability of 2.65 units per hectare. All holdings then have a high labour density.

8.7 Holdings with tree crops are shown in table 8.3.

Table: 8.3  
LABOUR DENSITY - TREE CROP HOLDINGS

holding size class (ha)	:	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	:	3.36	1.36	2.47	12
< .25	:	3.60	0.12	29.13	1
.25 - .5	:	4.05	0.41	9.92	2
.5 - .75	:	3.55	0.61	5.84	2
.75 - 1	:	2.90	0.96	3.01	1
1 - 1.25	:	3.50	1.12	3.12	1
1.25 - 1.5	:	2.90	1.50	1.93	1
1.5 - 1.75	:	2.90	1.85	1.57	1
1.75 - 2	:	3.20	2.21	1.45	1
2 - 2.5	:				
2.5 - 3	:	3.05	3.26	0.94	2
3 - 5	:				
5 - 10	:				
> 10	:				

8.8 There is again little or no apparent relationship between holding size and labour availability. The mean labour density is 2.47 units per hectare, falling off from 29.13 units per hectare on the smaller holdings to 0.94 units per hectare on the holding of 2.5 to 3ha in size.

8.9 Holdings are small and the availability of land is more likely to be a constraint to agricultural development than labour availability. This may be compensated to some extent by, or related to, the high incidence of professional or urban type employment in the area.

## Chapter: 9

### CROPPING PATTERNS

9.1 A "holding" is taken here to be the total area cultivated by a household. It includes all crops growing and land cleared, but does not include fallow which the family may have rights to cultivate.

9.2 A holding is divided into one or more "gardens", which are contiguous blocks of land growing similar crops. Only broad distinctions are made among crop types in gardens.

9.3 A garden may be subdivided into "plots" which are blocks within each garden growing a different crop mix, under different management, or planted at different times. Within plots detailed crop mixtures are recorded.

9.4 Table 9.1 describes cropping patterns at the garden level, maintaining the distinction between farmers with tree crop gardens and those without. A tree crop garden is taken to be a garden in which one or more plots have coconut or cocoa as the dominant crop.

9.5 Tree crop farmers have a mean holding size of 1.36ha, of which 1.08ha is tree crops and 0.28ha food crops. In contrast, non-tree crop farmers have a mean holding size of 0.41ha.

9.6 Tree cropping farmers tend to have only slightly more complex holdings, with an average of 3.25 gardens and 5.75 plots compared with 2.36 gardens and 3.64 plots among non-tree crop farmers.

9.7 Table 9.2 describes cropping patterns in more detail. This is derived from the aggregation of plot information in which complex mixtures are summarised by the dominant crop.

9.8 11 major crop mixture classes are listed in table 9.2, predominantly coconuts and cocoa and root crops.

Table: 9.1  
CROP COMPOSITION

i) All holdings

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	0.50	0.65	0.73	1.12	+++++
short term cash crops	0.09	0.23	0.31	1.35	.
food crops	0.27	1.88	3.58	1.90	++
total	0.86	2.76	4.62	1.67	

number of observations = 26

ii) Holdings with tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	1.08	1.42	1.58	1.11	+++++++
short term cash crops					
food crops	0.28	1.83	4.17	2.28	++
total	1.36	3.25	5.75	1.77	

number of observations = 12

iii) Holdings without tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops					
short term cash crops	0.16	0.43	0.57	1.33	+
food crops	0.25	1.93	3.07	1.59	++
total	0.41	2.36	3.64	1.54	

number of observations = 14

Table: 9.2  
CROPPING PATTERNS

main crop in mixture	all farmers		<----- farmers with ----->			
			no tree crops		tree crops	
	<-- area -->		<-- area -->		<-- area -->	
	(ha)	%	(ha)	%	(ha)	%
a Cleared Land	0.008	1	0.006	2	0.010	1
b Coconut	0.227	27			0.491	36
c Cocoa	0.162	19			0.352	26
z Coconut and Cocoa	0.110	13			0.238	17
d Pasture						
e Grain crops						
f Beans						
g Cabbage	0.003	0			0.008	1
h Vegetables	0.001	0	0.001	0		
i Spices						
j Fruit crops (pineapple)	0.137	16	0.222	53	0.037	3
k Fruit trees						
l Banana						
m Citrus trees						
n Nut trees						
o Sugar cane						
p Food/building tree						
q Tobacco						
r Sweet Potato	0.167	20	0.141	34	0.198	15
s Taro	0.007	1	0.007	2	0.008	1
t Yam	0.004	0	0.003	1	0.005	0
u Pana	0.018	2	0.027	7	0.007	0
v Cassava	0.008	1	0.009	2	0.008	1
w Other root crop						
I						I
I Total mean area (ha)	0.850		0.416		1.358	I
I						I
I Number of households	26		14		12	I
I						I

9.9 The dominant crops are coconuts and cocoa, fruit crops (predominantly pineapples) and root crops. The unusually diversified cropping pattern, in which four crops account for most of the farmed area, is illustrated in diagrams 9.1 to 9.3.

9.10 Table 9.2 is still a simplification of cropping patterns found in the field. Table 9.3 describes in more detail the crop mixtures grown by farmers. This no longer applies to a "model" holding but, in aggregate, detailed cropping patterns may be used to determine proportional areas under crop mixtures. Mixtures are listed hierarchically to the left of the table according to the relative dominance of each crop in the mixture. The three main crops are listed by name and any further crops are referred to by code letters. The column of "mean plot area" records the mean area of plots measured in the field according to the number of observations shown in the next column to the right. The column on the far right is the proportional area by crop mixture.

9.11 Crop mixtures illustrate the complexity of smallholder farming systems, in which 71 distinct mixtures are recorded. Small areas of vegetable and short term cash crops, together with a variety of tree crops, are typically scattered among food gardens. Again there is an unusually high incidence of young coconut and cocoa plantings in food gardens.

9.12 Table 9.4 summarises tree cropping. The table is in two parts, first showing the average number of trees and second the number of observations on which they are based. Each table is subdivided horizontally into cultivated garden and fallow, and vertically by garden type.

9.13 The averages in the top table are based on all plots (not only the plots in which trees are grown). In the far right column of the lower table is listed the number of observations for which trees are too numerous to count. These are excluded from the averages in the upper table.

# CROPPING PATTERNS

## all farmers

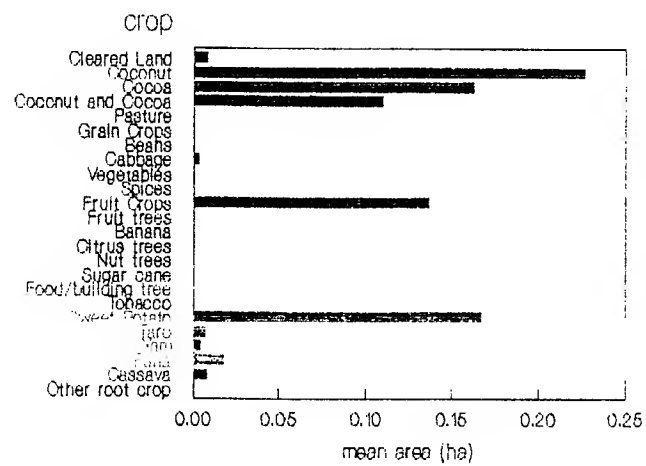


Diagram: 9.1

## CROPPING PATTERNS

### farmers with no tree crops

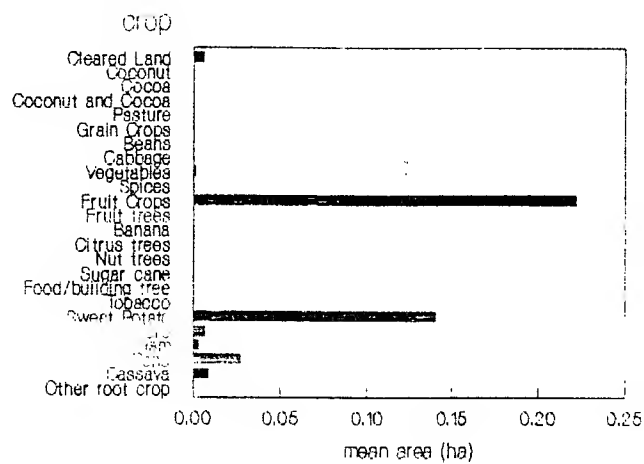


Diagram: 9.2

## CROPPING PATTERNS

### farmers with tree crops

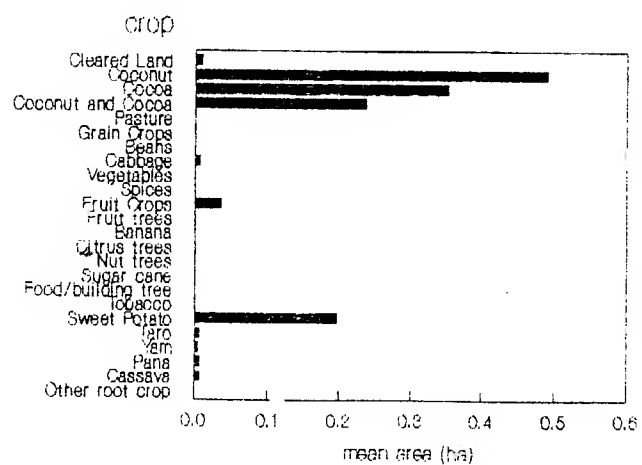


Diagram: 9.3



Table: 9.3  
DETAILED CROPPING PATTERNS

<----- main crop in mixture ----->				minor mixture code	mean plot area (ha)	number of plots	% plots	% area
crop code	<----- crop name ----->							
	first	second	third					
TOTAL					0.0683	120	100	100
a	Cleared land				0.0341	6	5	0.924
b	Coconuts				1.1789	5	4	26.63
		Cocoa			0.8094	1	1	3.658
c	Cocoa				0.5279	8	7	19.08
		Coconuts			0.4082	5	4	9.225
g	Cabbage	Vegetable	Cassava	o	0.0903	1	1	0.408
h	Vegetable				0.0220	1	1	0.099
j	Fruit crops				0.2578	7	6	8.155
		Coconuts			0.2809	2	2	2.539
			Nut trees		0.4404	1	1	1.990
		Banana	Sugar cane		0.4424	1	1	1.999
		Cassava			0.1523	2	2	1.376
r	Sweet potato				0.0541	20	17	4.889
		Cocoa			0.2771	1	1	1.252
			Coconuts	g	0.0496	1	1	0.224
			Cassava	g	0.0587	1	1	0.265
		Grain crops			0.0670	1	1	0.302
			Beans	v	0.0639	1	1	0.288
			Cabbage	h	0.0214	1	1	0.096
			Taro		0.1620	1	1	0.732
		Beans			0.0140	1	1	0.063
		Cabbage			0.0368	3	3	0.499
			Grain crops	sho	0.0360	1	1	0.162
			Banana	cbh	0.3532	1	1	1.596
			Taro	o	0.0287	1	1	0.129
			Cassava		0.1632	2	2	1.475
				o	0.0086	1	1	0.038
		Vegetable			0.0373	3	3	0.505
		Fruit crops			0.1330	2	2	1.202
			Cassava		0.0660	1	1	0.298
		Fruit trees			0.0554	1	1	0.250
		Banana	Sugar cane		0.0837	1	1	0.378
			Cassava		0.3368	1	1	1.522
		Taro	Cabbage	e	0.0514	1	1	0.232

# CROPPING PATTERNS (continued)

----- main crop in mixture ----->				minor mixture code	mean plot area (ha)	number of plots	% plots	% area
crop code	first	second	third					
r	r	Pana			0.0345	1	1	0.155
			Fruit crops	vg	0.0984	1	1	0.444
			Cassava		0.1088	1	1	0.491
		Cassava			0.0698	2	2	0.630
			Cocoa	b	0.0346	1	1	0.156
				bg	0.0429	1	1	0.193
				bu	0.1006	1	1	0.454
				g	0.0454	1	1	0.205
			Fruit crops	l	0.0534	1	1	0.241
			Fruit trees		0.0446	1	1	0.201
s	Taro				0.0156	2	2	0.141
		Beans	Grain crops		0.0452	1	1	0.204
		Cabbage	Fruit crops		0.0246	1	1	0.111
		Sweet potato	Banana		0.0294	1	1	0.132
		Other root	Vegetable	i	0.0627	1	1	0.283
t	Yam	Cocoa	Cassava	u	0.0611	1	1	0.276
		Taro			0.0381	1	1	0.172
u	Pana				0.0588	4	3	1.062
		Grain crops	Cabbage		0.0272	1	1	0.122
		Cabbage	Taro	f	0.0620	1	1	0.280
			Cassava	l	0.0159	1	1	0.071
		Tobacco			0.0306	1	1	0.138
		Sweet potato	Vegetable		0.0535	1	1	0.241
		Yam	Banana	sg	0.0345	1	1	0.155
v	Cassava				0.0135	1	1	0.061
		Fruit crops			0.1156	1	1	0.522
		Sugar cane	Fruit crops	k	0.0498	1	1	0.225
		Sweet potato	Cabbage		0.0251	1	1	0.113

## Crop Key:

a Cleared land	j Fruit crops	r Sweet potato
b Coconut	k Fruit trees	s Taro
c Cocoa	l Banana	t Yam
d Pasture	m Citrus trees	u Pana
e Grain crops	n Nut trees	v Cassava
f Beans	o Sugar cane	w Other root crop
g Cabbage	p Food/building tree	
h Vegetable	q Tobacco	
i Spices		

Table: 9.4  
TREE CROPS IN GARDENS

(----- average number of trees per garden -----)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) In cultivated gardens:					
fruit trees		0.13		0.28	0.22
citrus		0.12			0.03
nut trees		0.06		0.04	0.04
sweet banana				0.41	0.29
cooking banana				0.46	0.32
ii) In fallow of gardens:					
fruit trees					
citrus					
nut trees				0.02	0.01
sweet banana				0.09	0.06
cooking banana				0.09	0.06

(----- number of observations -----)

crop type:	cleared land	tree crops	short term cash crops	food crops	many but "unknown"
i) In cultivated gardens:					
fruit trees		16	6	46	4
citrus		17	6	49	
nut trees		17	6	47	2
sweet banana		15	5	46	6
cooking banana		15	5	46	6
ii) In fallow of gardens:					
fruit trees		17	6	47	2
citrus		17	6	49	
nut trees		17	6	48	1
sweet banana		17	6	47	2
cooking banana		17	6	47	2

9.14 Bananas, particularly for cooking, fruit trees and nut trees are crops of importance.

## Chapter: 10

### COCONUT AND COCOA

10.1 Coconut and cocoa have been studied in some detail before, both in the 1974-75 Sample Survey of Agriculture<sup>(5)</sup> and in the 1985 Coconut Survey<sup>(6)</sup>. Only comparative data are therefore included in the present survey.

10.2 Copra exports from Solomon Islands started in the late 19th century, rising from 1,220 MT in 1895 to 23,000 MT in the '20s and '30s. Following disruption during the second world war production did not achieve pre-war levels again until the 1960s. Copra production has continued to rise since, exceeding 40,000 MT in 1984 and 1985. Following cyclone Namu copra production fell by about 20 to 25%, but showed some recovery in 1987/88.

10.3 The structure of the copra economy has varied considerably since the start of trading. Initially a smallholder crop, the plantation sector came to dominate production from 1915 onwards. Since the 1970s smallholder production has been growing by about 4.5% annually and smallholder copra production now accounts for around 70% of the total<sup>(8)</sup>.

10.4 The area under smallholder coconuts has expanded considerably over the past 15 years, in part due to a subsidy scheme operating from 1968 to 1978 which was designed to encourage the rehabilitation, planting and replanting of coconut palms. Consequently the age structure of smallholder palms is young, with almost half the palms planted since 1970 and nearly 90% planted since the war<sup>(8)</sup>.

10.5 The total number of coconut palms in Solomon Islands is estimated to be around 9 million, covering an area of approximately 60,000 hectares. Table 10.1 shows the provincial breakdown of copra production, in which Western, Guadalcanal, Malaita and Central Provinces account for about 80% of production.

10.6 The mean national copra yield is 0.72 MT per hectare according to the 1985 Coconut Survey<sup>(7)</sup>. The 1974-75 Sample Survey of Agriculture found that the average number of coconuts per palm was 36 (30 in the 1985 Coconut Survey) and assumes an average whole nut weight of 1.2kgs with 190gm dried copra equivalent per nut. Disciplined plantings were found to yield 40% more per tree than customary plantings, but only 7% more per unit area because of the greater density of customary planted trees. This result was questioned in the 1985 Survey.

Table: 10.1

COPRA AREA AND PRODUCTION BY PROVINCE (1984)

Province	<-- area -->		<-- production -->		yield	number of palms
	(ha)	%	(MT)	%	(MT/ha)	
Western	14,454	25	13,816	32	0.96	2,093,795
Ysabel	5,230	9	2,969	7	0.57	817,555
Central	7,909	13	9,073	21	1.15	1,287,680
Guadalcanal	12,758	22	7,324	17	0.57	1,824,790
Malaita	11,890	20	5,575	13	0.47	1,980,595
Makira	3,555	6	2,662	6	0.75	540,810
Temotu	3,032	5	1,167	3	0.38	494,420
Total	58,918	100	42,586	100	0.72	9,039,645

Source: Statistics Office, Solomon Islands (1986), Statistical Bulletin 18/86

10.7 The yield from well maintained plantations was found to be higher than from poorly maintained plantations, but the 1985 Coconut Survey attributed this to more intensive harvesting rather than the productivity of palms<sup>(5)</sup>.

10.8 In the 1985 Coconut Survey soil type was classified into three broad categories. 41% of plots lay on sand or coral; 47% on black alluvial soils; and 21% on red clay. It was concluded that the reason for low yields is often area specific but soil nutrient deficiency, notably potassium, is an important factor. Despite this, and high copra prices at the time, the 1974-75 survey found that "fertilizer is only applied when provided under some sort of subsidy scheme" and that "smallholder farmers will not buy fertilizer to use on their own plots. There is generally a lack of understanding of the use of fertilizer by farmers, and in many cases a reluctance to use it even when it is provided at a subsidised price"<sup>(5)</sup>.

10.9 Other important factors identified in the 1985 Coconut Survey as affecting production were pests and disease. Over half the plots sampled in the 1985 suffered from Leaf Spot, which may refer to the symptoms of pest infestation or nutrient deficiency. One quarter of plots showed some evidence of White Thread, but it was felt that neither problem significantly affected output. About 40 to 50 percent of plots were felt to be disease free<sup>(7)</sup>.

10.10 Amblypelta cocophaga appeared to be a significant pest in parts of Western province, the Floridas, Guadalcanal and Malaita. 38% of households reported premature nutfall which is linked to Amblypelta in certain localities. Brontispa spp was also evident, and minor pests included rhinoceros beetle<sup>(7)</sup>, (Scapanes australis), rats, cockatoos, flying foxes and others.

10.11 The coconut survey of 1985 found that the average spacing of 7.5 metres for palms was not significantly different between triangular and square planted plots. On customary plantings there was a wide variation in planting density, but the majority of plots were similar to disciplined plantings<sup>(7)</sup>.

10.12 The 1974-75 sample survey of agriculture found that more than half of all immature palms were well maintained. Among bearing trees more than 60% of disciplined plantings were well maintained compared to 47% of customary planted palms<sup>(5)</sup>. The 1985 coconut survey found lower management standards, and that even with 30% of farmers hiring workers to assist with maintenance only 39% of plots were well brushed. 47% revealed weed growth<sup>(7)</sup> to shoulder height, and 13% of plots were totally neglected. The relationship between levels of maintenance, yield and soil conditions was not established in the 1985 survey.

10.13 Table 10.2 presents additional results from the present study. 5 plots of coconuts in pure stand are recorded, 8 plots of cocoa and 6 plots of coconut and cocoa.

10.14 Maintenance standards in the survey area are high, with most plots brushed at least to shoulder height. 26% of plots undercropped (ie new plantings in food gardens), 47% are brushed to ground level, 21% are brushed to shoulder height and only 5% have a ground cover of secondary bush. Maintenance levels are illustrated in diagram 10.1.

Table: 10.2  
COCONUTS AND COCOA

(----- % plots -----)  
coconut      cocoa      coconut  
                         + cocoa

i) Intercropping:

Pure stand	100	100	
Intercropping with:			
Coconut + cocoa			100
Short term cash crops			
Food crops			
Livestock			
-----			
Total %	100	100	100
Number of observations (plots)	5	8	6
-----			

ii) Maintenance:

Undercropped	20	13	50
Brushed to ground level	20	75	33
Brushed to shoulder height	40	13	17
Secondary bush	20		
Burnt			
-----			
Total %	100	100	100
Number of plots	5	8	6
-----			

iii) Coconut variety composition

Tall	100	100
Rennel		
Dwarf		
Other		
-----		
Total %	100	100
Number of plots	5	6
-----		

iv) Coconut age composition

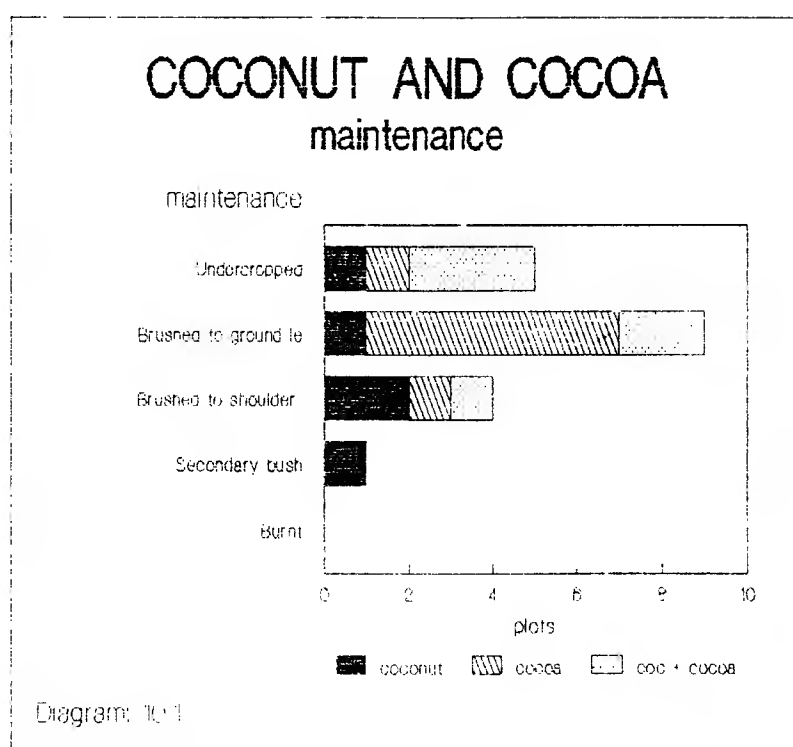
< 8 years	20	33
9 - 16 years		33
17 - 40 years	80	33
> 40 years		
senescent		
-----		
Total %	100	100
Number of plots	5	6
-----		

v) Cocoa age composition

< 3 years	14	33
3 - 5 years	16	27
6 - 25 years	70	40
> 25 years		
<hr/>		
Total %	100	100
Number of plots	8	6
<hr/>		

vi) Cocoa shade

coconuts		67
planted shade		
natural shade	88	33
planted and natural	13	
<hr/>		
Total %	100	100
Number of plots	8	6
<hr/>		





10.15 In the survey the coconut variety is local tall. 27% are less than eight years of age, 18% are in the age band 9-16 years and 55% are 17-40 years of age.

10.16 21% of cocoa plots are less than three years of age, 21% are in the age band 3-5 years and 58% are 6-25 years of age.

10.17 29% of cocoa stands are under purely coconut shade while 64% are under natural shade and 7% are under natural shade but with additional planted shade.

## Chapter: 11

### FALLOW

11.1 Throughout Solomon Islands almost all gardens are cultivated according to a form of shifting cultivation with bush fallow. In the 1974-75 Sample Survey of Agriculture it was found that, where population density or land tenure problems have restricted the availability of suitable land, the length of fallow may be reduced from the optimum 7 to 20 years to as little as one or two years. In such areas soil fertility is diminished through over frequent cropping<sup>(5)</sup>.

11.2 Solomon Islands soils generally have a low to very low potassium status. The geology of the country is composed in the main of rocks which are low in potassium bearing minerals, and potassium is readily leached under conditions of continuously high rainfall and rugged topography. Fallow is essential for the restoration of potassium fertility: "Under traditional shifting cultivation the depletion of potassium by crops is gradually reversed over a period of 3-15 years or more by a combination of mineral weathering and root systems incorporating potash in the nutrient cycle". Although burning leads to an erratic distribution of potassium in the topsoil, "the burning of vegetative trash is beneficial and it has been shown that topsoil potassium is increased by as much as 100% on average after burning,<sup>(9)</sup> all of this increase being held by the exchange complex".

11.3 Research on Malaita has shown that the average tuber yield of sweet potato is 9.3t/ha on sites of more than 10 years of fallow, falling off rapidly to 6.0t/ha on land of 5 - 9 years of fallow; 4.8t/ha on land of 0 - 4 years of fallow; and 3.5t/ha on successively cropped land. A residual yield of 2 - 6t/ha "seems to represent the rate of release of potassium from slowly available reserves in soil and weathering parent material within rooting depth". Large amounts of fertiliser are required to restore yields. A supply of 112kg/ha K is only marginally beneficial and inadequate to replenish the rate of potassium removal by the crop. 200 to 300kg/ha K is said to be required to restore<sup>(9)</sup> yields to levels commensurate with long fallow periods.

11.4 Phosphorus varies widely in its total and available forms, but Solomon Islands soils generally have low levels in the subsoil and medium levels of total phosphorus in the topsoil. Most soils used for agriculture have satisfactory levels of phosphorus but as land pressure increases deficiencies may become more widespread. Humus in the topsoil is accompanied by an increase in phosphorus, mainly in organic form, which may become readily available <sup>(9)</sup>.

11.5 Soil total nitrogen levels are generally adequate, with C:N ratios in the range 7-13 signifying the ready availability of nitrogen. Topsoil nitrogen is dependent on land use and in particular the length of fallow since there is a build-up of topsoil nitrogen under secondary regrowth. Sulphur is similarly associated with organic matter, and is higher under forest than under burned grassland <sup>(9)</sup>.

11.6 There is a close relationship between pH and organic matter. The lower the pH the greater the surface organic matter and the higher the subsoil organic carbon content. Difficulties associated with low pH such as aluminium toxicity are only likely to be widespread in the New Georgia group and possibly Ysabel. Alkaline soils are fairly widespread and are associated with reef limestone. The chief problem induced by alkaline calcareous soils is lime induced chlorosis of foliage which results from deficiencies of iron, manganese, zinc and copper <sup>(9)</sup>.

11.7 In addition there is a close relationship between soil depth and soil fertility. "All stable sites tend to favour an accumulation of maximum weathered material due to minimal losses by surface erosion. Thus there arises the paradox that on stable hill sites and terraces the soils tend to be deepest but least fertile, while on adjacent steep slopes the soils are relatively unweathered, and hence fertile, but shallow" <sup>(9)</sup>.

11.8 The shifting system of smallholder agriculture in Solomon Islands is suited to the environment and prevailing management where land pressure is low. Soil fertility is restored during fallow periods, and small isolated areas of mixed cropping are not conducive to pest build-up. Burning of surface vegetative trash not only releases a flush of nutrients, of which the most important is potassium, but is also a useful phytosanitary measure which destroys weed seeds, some insects and undesirable pathogens <sup>(9)</sup>.

11.9 An analysis of fallow therefore tells much about the dynamics of smallholder agriculture, and likely pressures on farming systems. Hansell and Wall<sup>(10)</sup> state that "there is little doubt that the major factor influencing the decision to abandon the garden is the decline in crop productivity but the exact causes of the decline are not fully understood". The greatest decline in production is between the first and second crops, rather than between the second and subsequent crops. They estimate that despite reduced yields there is still a good return from a low input of labour and conclude that reduced yields alone is insufficient reason for the abandonment of a garden. An important consideration may be the build-up of soil-borne plant diseases causing the rotting of corms or tubers, insect attack and weed infestation<sup>(10)</sup>.

11.10 In the 1974-75 Sample Survey of Agriculture<sup>(5)</sup> it was stated that, while in overall terms Solomon Islands cannot be said to be suffering from land pressure, it may occur in some areas. Table 11.1 shows the distribution of garden land by the length of the bush fallow in 1975.

Table: 11.1  
LENGTH OF BUSH FALLOW (1975)

length of bush fallow (years)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 2	23	6	17	16	14
2 - 4	20	5	33	14	18
5 - 7	4	11	25	12	15
8 - 10	10	10	8	15	10
> 10	13	20	3	14	13
never previously cultivated	29	48	15	29	32
Mean length fallow (years)	5.6	9.2	4.5	6.7	6.4

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.11 Table 11.2, also from the 1974-75 survey, shows the distribution of garden land by length of cultivation.

Table: 11.2  
LENGTH OF CULTIVATION (1975)

length of cultivation (months)	Western	Ysabel Central Guadalcanal	Malaita	Makira Tenotu	Solomon Islands
	% observations				
< 4	20	45	11	19	27
4 - 6	62	31	36	22	37
7 - 9	12	13	25	33	19
10 - 12	5	8	14	18	10
> 12	2	4	14	8	7
Mean cultivation (months)	5.1	4.7	7.6	7.2	6.0

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.12 In 1975 it was found that 32% of gardens in Solomon islands had never been previously cultivated, and that the average length of bush fallow of cultivated gardens was 6.4 years. Only 7% of gardens were generally cultivated for more than 12 months before reverting to fallow, and the average length of cultivation of food gardens was 6 months.

11.13 Table 11.3 summarises cropping intensity in the survey area. The crop period is shown in the first column, which is the time from planting to harvest for the named crop.

Table: 11.3  
CROPPING INTENSITY

crop type		harvest to harvest (months)	number of crops in sequence	number of cases (obs)
all crops		5.4	2.3	120
cleared land	a	7.0	1.0	6
coconut	b	4.6	1.8	5
cocoa	c	2.2	1.5	8
coconut + cocoa	z	2.6	2.0	6
cabbage	g		1.0	1
vegetable	h	3.0	3.0	1
fruit crops	j	8.8	2.5	13
sweet potato	r	4.6	2.5	58
taro	s	7.8	2.2	6
yam	t	6.5	4.0	2
pana	u	7.2	2.5	10
cassava	v	7.5	3.3	4

11.14 The second column describes the number of times an area is cropped in sequence before reverting to fallow. This introduces complexity since the crop type may, and commonly does, change within the sequence. The table therefore shows different stages in the cropping sequence. The dominant root crop is sweet potato with 58 observations, while taro, yam, pana and cassava have 22 observations.

11.15 Table 11.4 describes the fallow period, however, this has little meaning for tree crops since the interpretation of fallow varies with the age of the tree crop and previous cropping history. For food crops the fallow period relies on the knowledge of the respondent. Often it is found that long fallow periods are beyond the memory of operators and these are referred to as "cases longer than memory". 36% of gardens have such long fallows. Where the fallow period is known on food gardens there are 3.4 years of fallow between cropping.

Table: 11.4  
FALLOW PERIOD (years)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
mean years of fallow		0.8		3.4	2.6
standard deviation (years)		1.6		4.1	3.8
number of cases (gardens)		9	4	33	46
cases longer than memory					26
total cases (gardens)					72

11.16 Fallow periods cover a range of soil and site conditions, and are themselves variable. Table 11.5 shows that 33% of fallow periods on food gardens are longer than memory, extending over 44% of the food garden area.

Table: 11.5  
FALLOW RANGE

i) Fallow Range by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow		6	4	6	16
1 year		2		6	8
2 years				2	2
3 years				11	11
4 years					
5 years		1		5	6
6 - 10 years					
11 - 20 years				3	3
21 - 50 years					
beyond memory ("long time")		8	2	16	26
total by crop type		17	6	49	72

ii) Fallow Range by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow		27	5	5	36
1 year		9		5	14
2 years					
3 years				9	9
4 years					
5 years					
6 - 10 years					
11 - 20 years					
21 - 50 years					
beyond memory ("long time")		23	5	14	41
total by crop type		59	9	32	100

Note: The table of % area is only approximate due to rounding small numbers



11.17 The type of fallow in the survey area is shown in table 11.6.

Table: 11.6  
FALLOW TYPE

i) Fallow type by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		2	2	2	6
secondary forest		4		18	22
dense thicket		5		22	27
open scrub grassland					
grassland					
plantation trees/planted				1	1
continuous cropping		6	4	6	16
total by crop type		17	6	49	72

ii) Fallow type by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		14	5		18
secondary forest		14		9	23
dense thicket		14		14	27
open scrub grassland					
grassland					
plantation trees/planted					
continuous cropping		18	5	9	32
total by crop type		59	9	32	100

Note: The table of % area is only approximate due to rounding small numbers

11.18 38% of all gardens have a fallow of primary or secondary forest extending over 41% of the farmed area.

11.19 Only 4% of the food gardens are cut from primary forest, representing an insignificant area. 12% of tree gardens are cut from primary forest on 24% of the tree crop area. Such results suggest that the area for expansion in the survey area is very limited and that cropping is becoming intensive.

11.20 Table 11.7 summarises the application of agricultural inputs for the control of pests and maintenance of soil fertility. In the survey no application of any type of fertiliser was encountered. In one case a pesticide of unknown identification was applied to a sweet potato plot.

Table: 11.7

MANAGEMENT AND APPLICATION OF AGRICULTURAL INPUTS

i) Inputs by frequency of use (gardens)

crop type		row planting	fert- iliser	pest- icide	compost	ash	other	frequency of plots
all crops		26		1				120
cleared land	a							6
coconut	b	2						5
cocoa	c	7						8
coconut + cocoa	z	6						6
cabbage	g							1
vegetable	h							1
fruit crops	j	11						13
sweet potato	r			1				58
taro	s							6
yam	t							2
pana	u							10
cassava	v							4

ii) Inputs by % area applied

crop type		row planting	fert- iliser	pest- icide	compost	ash	other
all crops		65					
cleared land	a						
coconut	b	20					
cocoa	c	15					
coconut + cocoa	z	15					
cabbage	g						
vegetable	h						
fruit crops	j	15					
sweet potato	r						
taro	s						
yam	t						
pana	u						
cassava	v						

Note: The table of % area is only approximate due to rounding small numbers

## Chapter: 12

### LANDFORM

12.1 The survey area is among the villages of the western coastal plain south of Auki. The area is characterised by a broad, low-lying plain which is swampy over extensive areas, and abruptly rising hills to the north-eastern interior.

12.2 Landforms are broadly subdivided into "lowland" and "upland" where "upland" simply means above the coastal plain or coastal terrace, but does not imply high elevation. Table 12.1 shows the distribution of cultivated land in the survey by landform. The first part of the table records the number of observations (gardens) which is expressed in area terms in the second part of the table.

12.3 65% of tree gardens representing 53% of the tree garden area are on lowland sites, with 35% of gardens on 47% of the tree garden area on upland sites of varying steepness. 24% of food crop gardens representing 22% of the food garden area are on lowland sites, while 76% of gardens representing 72% of the food garden area are on upland sites. Short term cash crops, covering 9% of the farmed area are on upland sites.

Table: 12.1

## LANDFORM

i) Landform by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach					
lowland plain		10		9	19
depression (poor drainage)				1	1
swamp				1	1
river channel		1			1
uplifted terrace				1	1
ii) Upland					
valley terrace					
river channel			1	2	3
hill slope < 8 degrees		3	4	10	17
hill slope 8 - 30 degrees		2	1	20	23
hill slope > 30 degrees		1		3	4
ridge				2	2
total by crop type		17	6	49	72

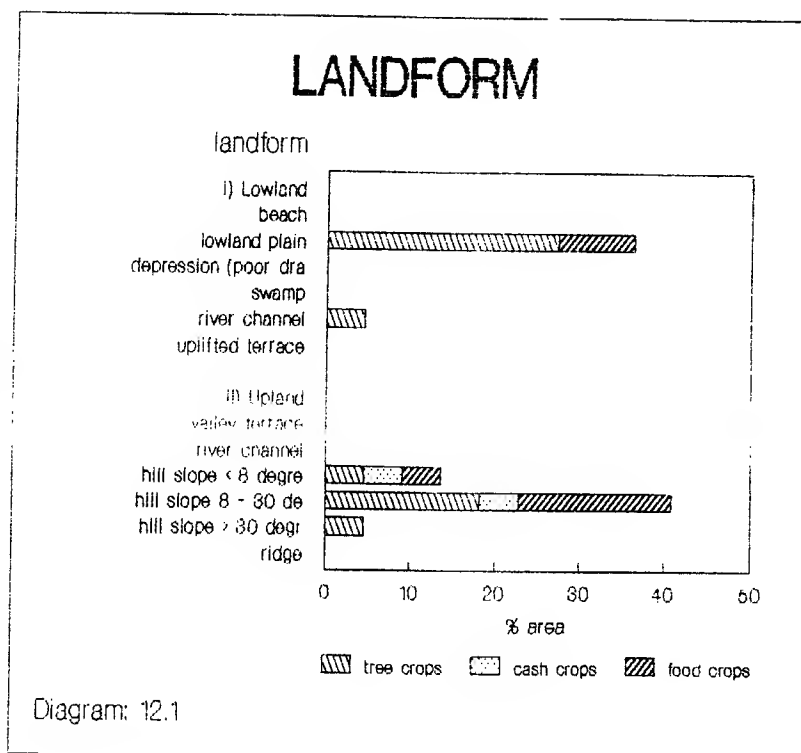
Note: Short term cash crops are pineapples

ii) Landform by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach					
lowland plain		27		9	36
depression (poor drainage)					
swamp					
river channel		5			5
uplifted terrace					
ii) Upland					
valley terrace					
river channel					
hill slope < 8 degrees		5	5	5	14
hill slope 8 - 30 degrees		18	5	18	41
hill slope > 30 degrees		5			5
ridge					
total by crop type		59	9	32	100

Note: The table of % area is only approximate due to rounding small numbers

12.4 A summary of landform and cropping is illustrated in diagram 12.1.



12.5 Table 12.2 describes the characteristics of slope in farming systems. The first part of the table records the frequency of observations (plots) which is expressed in area terms in the second part of the table.

12.6 The mean slope is 6 degrees, with 61% of plots representing 60% of the cropped area on land of less than 5 degrees slope. Only 9% of gardens on 20% of the cropped area are on slopes of greater than 10 degrees.

Table: 12.2  
SLOPE

i) Slope by number of observations (plots)

crop type	mean slope (degrees)	frequency of plots at different degrees of slope						frequency of plots
		0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	> 50 degrees	
all crops	6	73	36	5	4	2		120
cleared land	a	4	2					6
coconut	b	3		1	1			5
cocoa	c	6	2					8
coconut + cocoa	z	4	1	1				6
cabbage	g	1						1
vegetable	h	1						1
fruit crops	j	9	4					13
sweet potato	r	32	19	2	3	2		58
taro	s	4	2					6
yam	t	1	1					2
pana	u	5	4	1				10
cassava	v	3	1					4

ii) Slope by % cropped area

crop type		frequency of plots at different degrees of slope						total
		0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	> 50 degrees	
all crops		60	20	15	5			100
cleared land	a							
coconut	b	15		10	5			30
cocoa	c	10	10					20
coconut + cocoa	z	10		5				15
cabbage	g							
vegetable	h							
fruit crops	j	10	5					15
sweet potato	r	15	5					20
taro	s							
yam	t							
pana	u							
cassava	v							

Note: The table of % area is only approximate due to rounding small numbers



12.7 Table 12.3 summarises conservation measures. No conservation practices or alley cropping were encountered in the survey.

Table: 12.3  
CONSERVATION AND ALLEY CROPPING

i) Conservation by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing		17	6	49	72
ii) Alley cropping not performed performed		17	6	49	72
total by crop type		17	6	49	72

ii) Conservation by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing		59	9	32	100
ii) Alley cropping not performed performed		59	9	32	100
total by crop type		59	9	32	100

Note: The table of % area is only approximate due to rounding small numbers





12.8 The spatial distribution of gardens is shown in diagrams 12.2 to 12.4, which illustrate the relationships between crop type, crop area, and the distance of gardens from households.

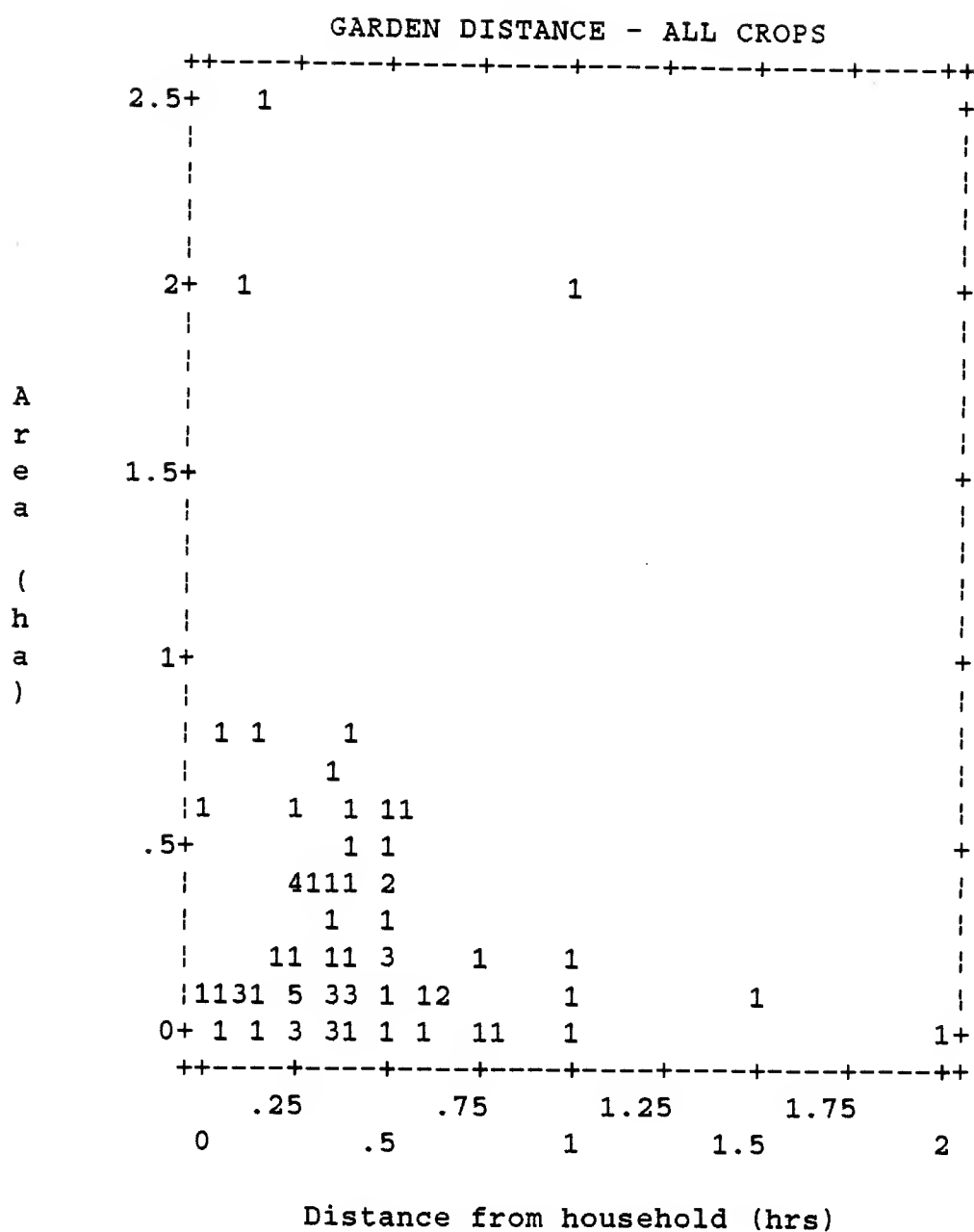
2.9 Diagram 12.2 is the graph of gardens for all crops, while subsequent diagrams show the distance relationships for the major crop types. The graph shows the relationship between garden area (vertical axis) and the time taken to reach the garden from the household (horizontal axis). Graph entries represent the number of observations (gardens) and are numbered from 1 to 9 and thereafter alphabetically. Thus where points coincide the number of points is shown: 9 occurrences is recorded as "9"; 10 occurrences as "A"; 13 occurrences as "D"; and so on.

12.10 The mean time taken to reach gardens is .288 hours or about 17 minutes, with a maximum time of 2 hours. The largest gardens tend to be closest to the household.

12.11 Diagram 12.3 shows the relationship between distance and area of tree crop gardens. The mean time taken to reach tree crop gardens from the household is .194 hours, with a maximum recorded time of 1.00 hour.

12.13 The mean time taken to reach food gardens from the household is .313 hours, with a maximum time of 2.00 hours. The spatial distribution is similar for short term cash crops.

Diagram: 12.2

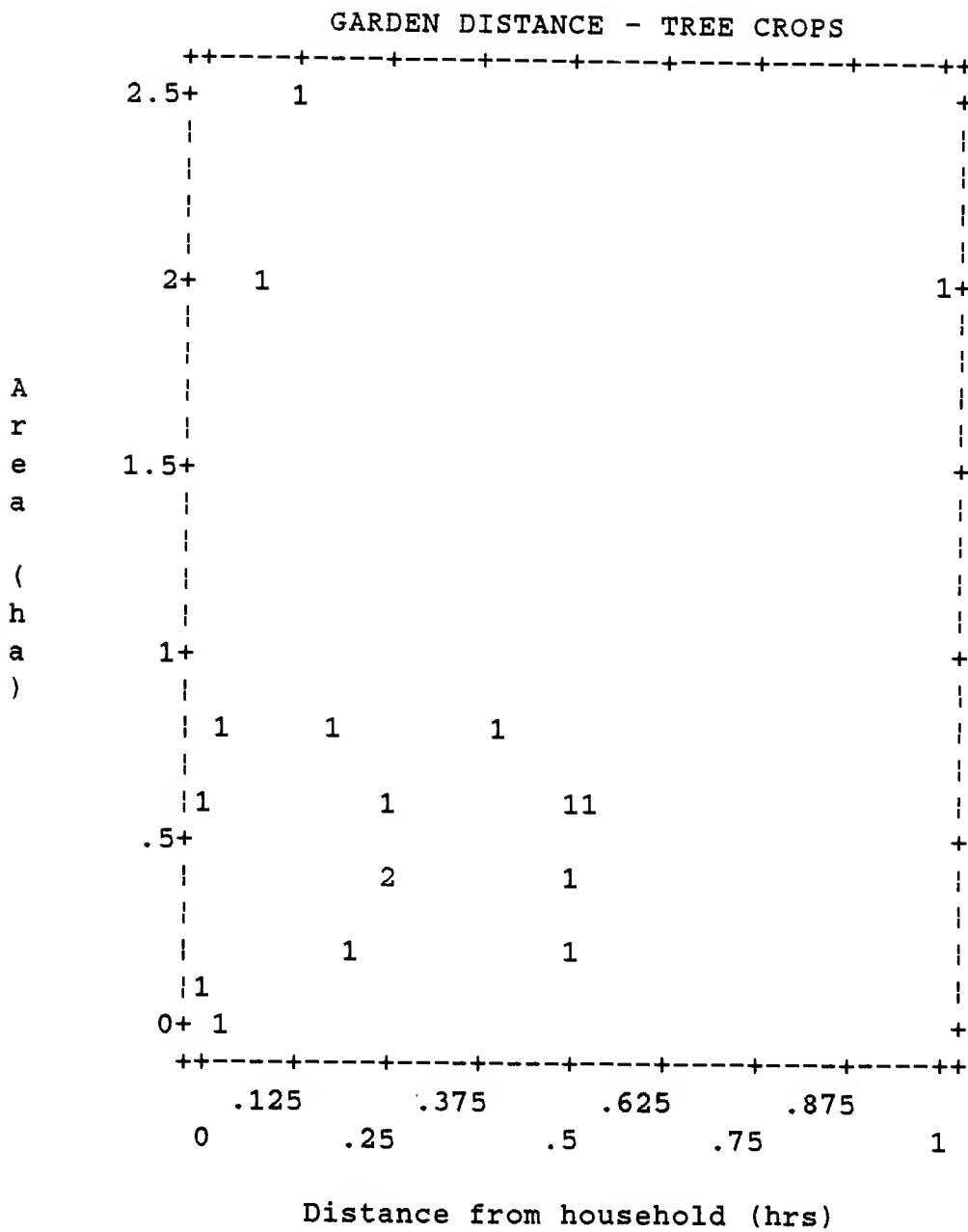


Mean = .288 hrs

Max = 2.00 hrs

Number of observations (gardens) = 72

Diagram: 12.3

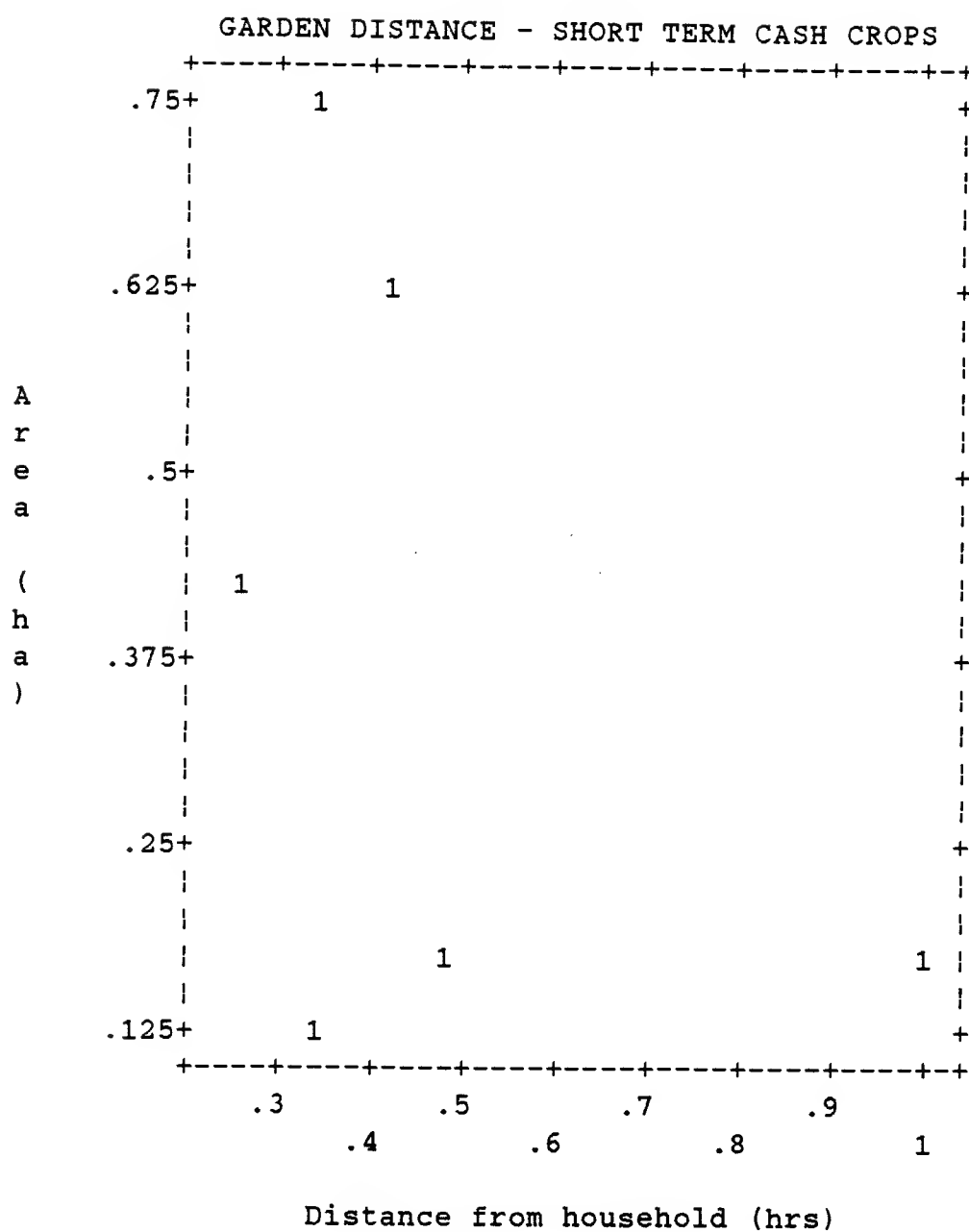


Mean = .194 hrs

Max = 1.00 hrs

Number of observations (gardens) = 17

Diagram: 12.4

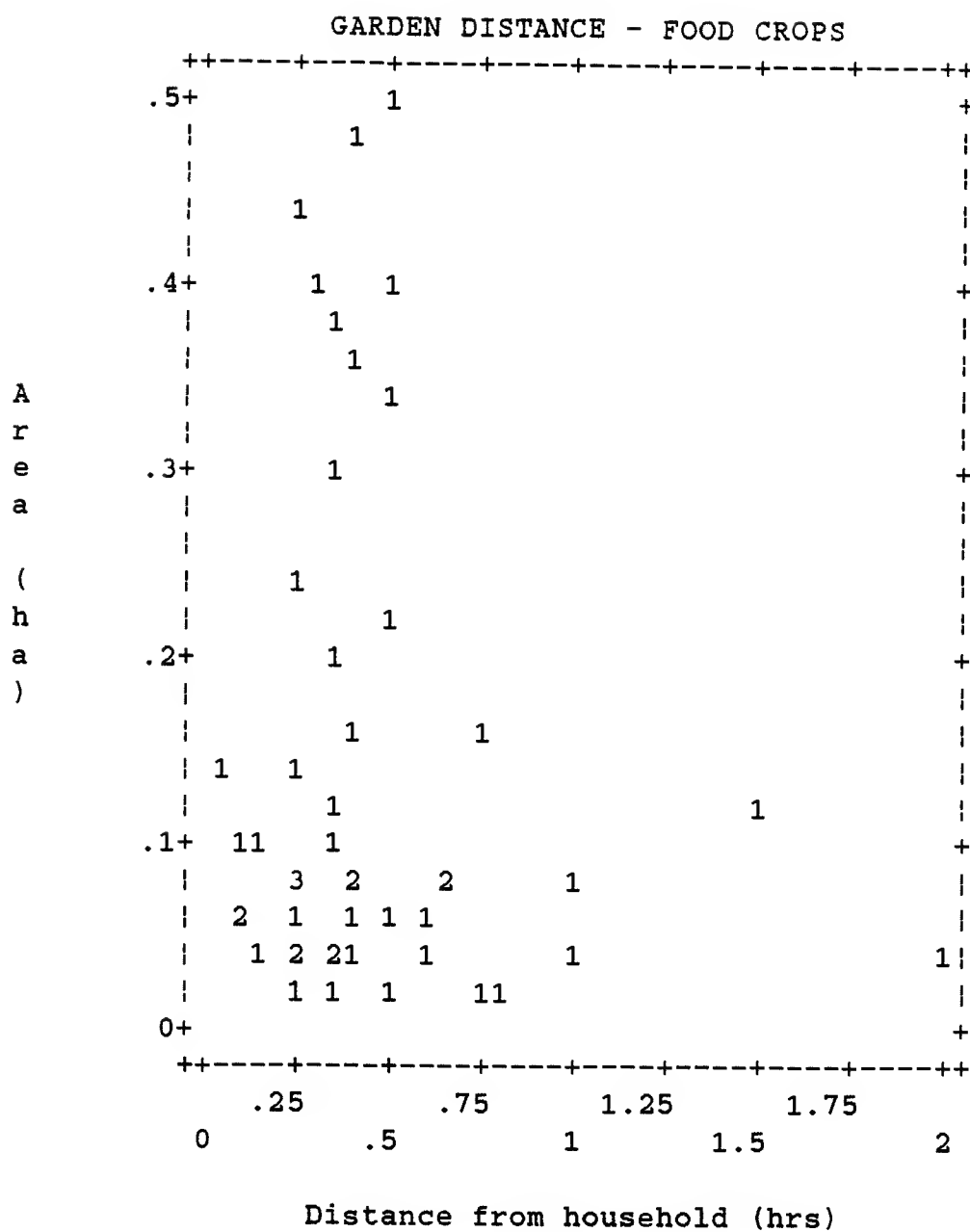


Mean = .348 hrs

Max = 1.00 hrs

Number of observations (gardens) = 6

Diagram: 12.5



Mean = .313 hrs

Max = 2.00 hrs

Number of observations (gardens) = 49

## Chapter: 13

### ADVERSE FACTORS AFFECTING PRODUCTION

13.1 Table 13.1 describes site factors which farmers regard as problems. The first part of the table specifies the number of observations (gardens), which is expressed as the proportion of cultivated area affected in the second part of the table.

Table: 13.1

#### SITE CONDITIONS

i) Site Conditions by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		12	1	30	43
poor soil/site		1		2	3
pest/disease problem		1	3	8	12
poor site + pests		1		2	3
weed problem				4	4
weeds + poor site				1	1
weeds + pests		2	2	2	6
weeds + site + pests					
total by crop type		17	6	49	72

ii) Site Conditions by % cultivated area

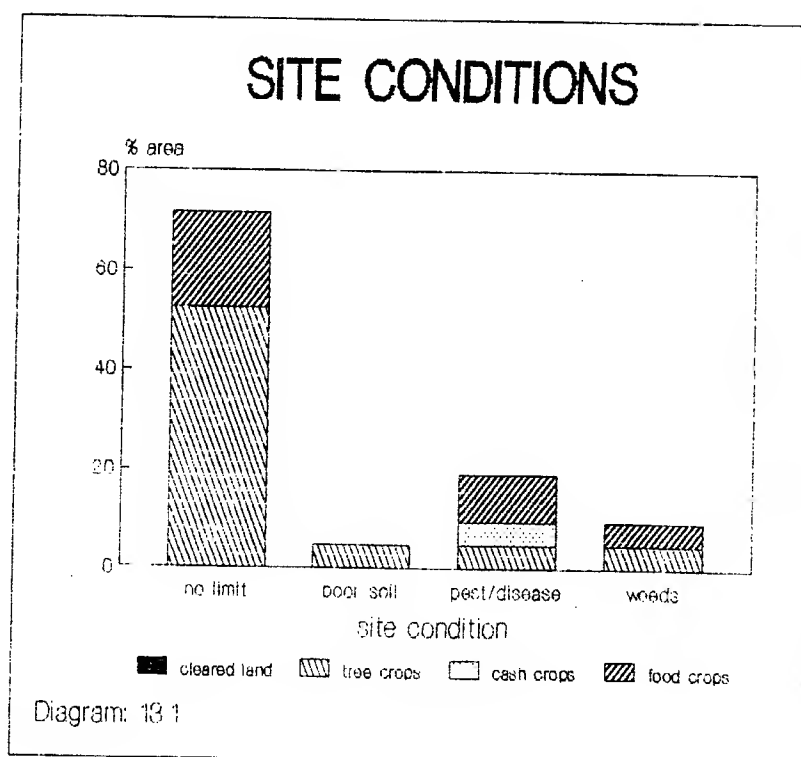
crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		52		19	71
poor soil/site		5			5
pest/disease problem			5	10	14
poor site + pests					
weed problem				5	5
weeds + poor site					
weeds + pests		5			5
weeds + site + pests					
total by crop type		62	5	33	100

Note: The table of % area is only approximate due to rounding small numbers

13.2 60% of all gardens (43 gardens) representing 71% of the cultivated area have no apparent site limitations. Site problems may be summarised by grouping the main factors as follows:

	<u>% gardens</u>	<u>% area</u>
No site limitations	60	71
Poor soil/site	10	5
Pests/disease	29	19
Weeds	15	10

Site conditions are illustrated in diagram 13.1.





13.3 The major problems are predominantly on food crops. Pests and disease affect 48% of the cultivated area and weeds affect 24% of the cultivated area. Soil and site problems are encountered only over small areas.

13.4 Table 13.2 describes major crop damage. Cyclone damage on tree crops affects 18% of gardens on 32% of the tree crop area. Overall 19% of the cropped area, on tree crops, is affected by cyclone damage. A variety of "other factors" affect 35% of gardens on 32% of the cropped area.

Table: 13.2  
CROP DAMAGE

i) Crop Damage by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		10	4	31	45
cyclone damage		2			2
other damage		4	2	18	24
cyclone and other damage		1			1
total by crop type		17	6	49	72

Note: "Other" damage is frogs and crabs

ii) Crop Damage by % cultivated area

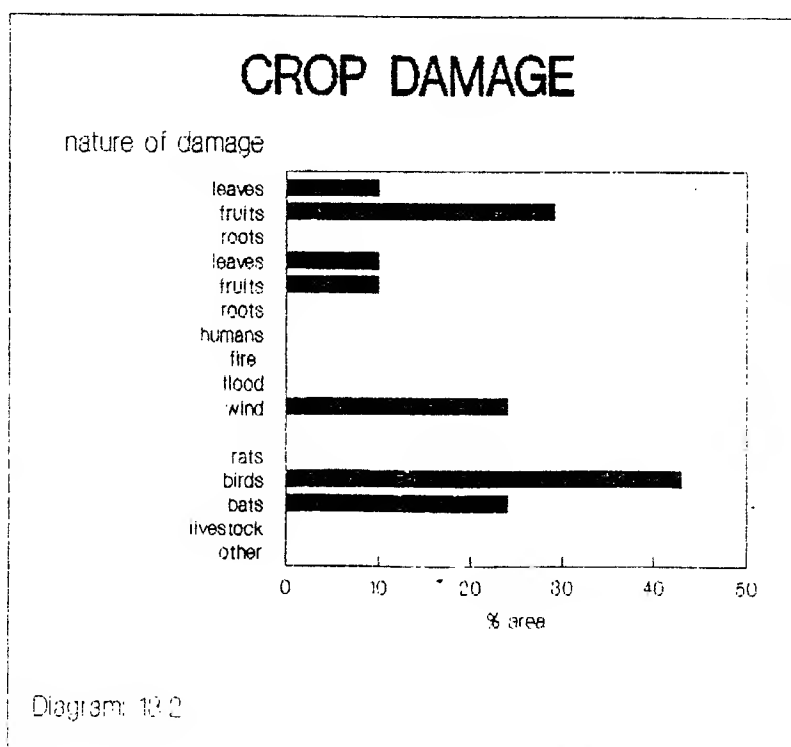
crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		27	5	23	55
cyclone damage		14			14
other damage		14	5	9	27
cyclone and other damage		5			5
total by crop type		59	9	32	100

Note: The table of % area is only approximate due to rounding small numbers

13.6 Annex 3 provides a more detailed description of factors damaging crop mixtures, summarised at the plot level. It is not possible at this stage to present results at the crop level. Results are summarised in table 13.3 and are illustrated in diagram 13.2.

Table: 13.3  
SUMMARY OF CROP DAMAGE

nature of damage		% cropped area affected
insects affecting	leaves	10
	fruits	29
	roots	
disease affecting	leaves	10
	fruits	10
	roots	
damage due to	humans	
	fire	
	flood	
	wind	24
	rats	43
	birds	24
	bats	
	livestock	
	other	



## Chapter: 14

### CROP YIELDS

14.1 Production data on smallholder agriculture are scarce, largely due to practical difficulties associated with measuring yields in complex cropping systems that lack clear temporal and spatial boundaries. Smallholder agriculture is a continuous process in which there is little seasonality, so that any or all stages of crop growth and management operations may be exhibited at any time, with crops commonly harvested selectively over time. Table 14.1 summarises the planting characteristics of smallholder crops in the survey area.

Table: 14.1  
CROP VARIETY AND SPACING

<----- crop type ----->		number of observations	% improved	<----- spacing (% obs) -----> customary	regular	recommended	<---- tree crops ----> triangular      square
Cleared	Cleared land	1					
Coconut/Cocoa	Coconuts	20		35	25	5	35
	Cocoa	23	61	22	17	39	22
Ground crops	Grain crops	11	36	100			
	Beans	5	40	100			
	Cabbage	29	7	100			
	Vegetable	17	24	94	6		
	Chillie						
	Fruit Crops	27	7	41	11	48	
Tree/other crops	Fruit trees						
	Banana	11		100			
	Citrus trees						
	Nut trees	4		100			
	Sugar cane	8		100			
	Food/building tree						
	Tobacco	1		100			
Root crops	Sweet potato	61	2	100			
	Taro Common	13		100			
	Giant						
	Hong Kong						
	Swamp	4	25	100			
	Yam	5		100			
	Pana	15		100			
	Cassava	29		100			
	Other root crop						
Total		284					

14.2 The second column refers to the introduction of non-traditional planting material, either through extension or research, or from other sources.

14.3 For non-tree crops there are three types of spacing identified, being "customary", "regular" and "recommended". "Customary" means there is no discernable order in the plot. "Regular" means planting according to a visible pattern, such as in rows. "Recommended" refers to the adoption of recommended practices, which may not necessarily be "regular". For tree crops there are four categories of "customary", "regular", "triangular" and "square". "Customary" and "regular" follow the same rules as non-tree crops. "Triangular" and "square" equate with recommended practices for coconuts.

14.4 Crop mixtures in smallholder farming systems are complex, as seen in table 9.3. Table 14.2 describes something of the complexity of planting densities. In general around 40% of root crops are pure stand, but for the most part crops are grown in complex mixtures.

Table: 14.2  
CROP DOMINANCE IN MIXTURES

----- crop type -----		number of observations	----- % dominance in mixture -----										
			0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100	
Cleared	Cleared land												
Coconut/Cocoa	Coconuts	20	50	10		10	5						25
	Cocoa	23	22	9		9	4	4	4	4	9		35
Ground crops	Grain crops	11	35	10		9							
	Beans	5	50	40									
	Cabbage	29	69	24	3			3					
	Vegetable	17	88	12									
	Chillie												
	Fruit Crops	27	37	4		7	4			15	4		30
Tree/other crops	Fruit trees												
	Banana	11	73	18		9							
	Citrus trees												
	Nut trees	4	100										
	Sugar cane	8	100										
	Food/building tree												
	Tobacco	1	100										
Root crops	Sweet potato	61	2	2	2	10	3	3	8	20	13		33
	Taro Common	13	38	15	8		8				15		15
	Giant												
	Hong Kong												
	Swamp	4	75		25								
	Yam	5	20		20	20					20		
	Pana	15	27		7	13				13	7		20
	Cassava	29	59	21	10		3			3			
	Other root crop												
Total		283											

14.5 A visual assessment of yields is presented in table 14.3.

Table: 14.3  
CROP PRODUCTION

<----- crop type ----->		number of observations	<----- yield appearance (% obs) ----->			
			zero	low	moderate	high
Cleared	Cleared land	1	100			
Coconut/Cocoa	Coconuts	20		20	45	35
	Cocoa	23		26	48	26
Ground crops	Grain crops	11		9	73	18
	Beans	5			60	40
	Cabbage	29		7	69	24
	Vegetable	17		12	65	24
	Chillie					
	Fruit Crops	27		4	48	48
Tree/other crops	Fruit trees					
	Banana	11		27	64	9
	Citrus trees					
	Nut trees	4		25	75	
	Sugar cane	8		25	63	13
	Food/building tree					
	Tobacco	1			100	
Root crops	Sweet potato	61		5	67	28
	Taro Common	13		8	92	
	Giant					
	Hong Kong					
	Swamp	4			75	25
	Yam	5			80	20
	Pana	15			53	47
	Cassava	29		10	69	21
	Other root crop					
Total		284				

14.6 Crop yields are variable but for the most part are moderate to high.

14.7 In an intensive case study of this kind it is difficult to obtain a reasonable coverage of crop yields, although these are recorded where possible in the course of the survey<sup>(12)</sup>. A crop production study has been designed to generate yield data<sup>(22)</sup> but it has not been possible to implement this yet. For the present report yields are largely derived from secondary sources.

a) COCONUT:

14.8 Coconut production data from the 1974-75 agricultural survey are summarised in table 14.4.

Table: 14.4

COCONUT PRODUCTION DATA FROM 1974-75 AGRICULTURAL SURVEY

	Province				Mean
	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
number of yield sites	28	32	3	30	93
coconuts per palm: disciplined	53	54	19	34	44
customary	22	36	1	41	31
mean	31	42	14	37	36
coconuts per ha : disciplined	8,194	8,983	2,822	5,773	7,178
customary	4,658	8,595	135	7,432	6,703
mean	5,794	8,753	1,926	6,492	6,913
% damaged/unusable nuts: disciplined	12	10	12	20	14
customary	19	13	36	6	13
mean	16	12	12	13	14
gross copra yield (kg/ha): disciplined	1,541	1,689	531	1,086	1,450
customary	876	1,616	25	1,398	1,261
mean	1,081	1,646	362	1,221	1,300
net yield (kg/ha): disciplined	1,356	1,520	467	869	1,247
customary	709	1,406	16	1,314	1,097
mean	908	1,448	318	1,062	1,118

Source: Statistics Office (1978) "1974-75 Agricultural Statistics Survey".

Note: Copra yields assume 190gm dried copra per nut quoted in the Statistics Office report

14.9 In the 1974-75 agricultural survey the mean coconut yield is estimated to be 1,300kg/ha copra equivalent, or 1,118kg/ha when unusable nuts are discounted. The average daily consumption of coconuts was found to be 4.2 per household, resulting in a national annual consumption equivalent of 8,871MT copra. If green nuts are taken into account it was<sup>(5)</sup> believed that the copra equivalent consumed would be 10,000MT<sup>(5)</sup> in a year when exports amounted to 28,000MT.

14.10 Charles (1980) estimates lower levels of copra production with estate yields of 827kg/ha and smallholder yields of 410kg/ha. The difference he attributed to a high proportion of immature plantings<sup>(23)</sup> and the consumption of coconuts in the smallholder sector. Average copra production derived from the 1985 coconut survey is estimated in the (draft) Farm Management Handbook for Solomon Islands to be 0.72MT/ha<sup>(24)</sup>, although provincial yields vary from 1.15MT/ha in Central Province, which is dominated by the Levers plantation in the Russel Islands, to 0.38MT/ha in Temotu.

14.11 In conjunction with the 1985 coconut survey the Research Department of the Ministry of Agriculture and Lands has analysed the nutrient status of coconut soils in Solomon Islands<sup>(13)</sup>:

Coconut Soils Data:  
(means of soils analyses conducted on Coconut Survey soils)

pH	N%	avaialble P ppm	exchangeable K meq/100g	avaialble K meq/100g
6.4	0.55	70	0.24	0.60



14.12 It was concluded that coconut soils are generally high in nitrogen, medium in phosphate, and low in potassium. Recent variety experimental results on fertilised coconuts show the following yields:

Coconut Research Results (dry copra eq kg/ha):

Site	Tenaru (Guadalcanal)	Gizo (Western)
Year	1985 : 1984	1985 : 1984
Dwarf:Rennel Hybrid	378 : 2,664	1,990 : 1,599
Dwarf:Local Tall Hybrid	383 : 1,391	:
Local Tall	:	1,830 : 334
Rennel	190 : 1,391	1,910 : 1,052
Mean	:	: 995

14.13 Only one smallholder yield of 173kg/ha (2.47 bag/ha) was obtained in the present survey. Without further evidence of low yields smallholder yields in the present report are estimated to be 800kg/ha dry copra equivalent usable nuts.

b) COCOA:

14.14 Research trials on cocoa<sup>(13)</sup> from 1977 to 1985 at Black Post in Guadalcanal produced a mean dry beans yield of 1,898kg/ha for Amelonado, 2,780kg/ha for AmlxNa33 hybrid, and 2,444kg/ha for AmlxPa7 hybrid.

14.15 Cocoa yields from various sources are quoted in the (draft) Farm Management Handbook for Solomon Islands<sup>(24)</sup>:

Smallholder Cocoa Yields (kg/ha)<sup>(24)</sup>:

Age of tree (year)	3	4	5	6	7	8
Friend (1970)	21	126	215	220	220	173
DBSI (1983) *	150	250	600	1,200	1,450	1,450
Hiele (1988)	208	450	560	685	719	719

\* unverified source

14.16 High variability in yields was attributed to differences in management, such as in the application of fertiliser, weeding, and pest and disease control.

14.17 Cocoa is an important crop in the survey area. Seven yield observations were made with a mean yield of 150kg/ha (2.31 bags/ha). Again this appears low and smallholder cocoa yields are estimated in the present report to be 600kg/ha dry beans.

c) SWEET POTATO:

14.18 In a study of north-west Malaita, Frazer<sup>(15)</sup> investigated the effect of fallow period on smallholder sweet potato yields. After a long fallow of 15-20 years the mean yield was found to be 14.84MT/ha from 8 observations. After a "short" fallow of less than 10 years the mean yield was 8.99MT/ha from 5 observations. Gollifer<sup>(16)</sup> looked at the effects of potassium and nitrogen application on annual crops on soils of the Dala Series in Malaita, soils formed on a parent material of raised coral reef and characteristically low in potassium. He found unfertilised sweet potato yields of 5.5MT/ha (control for K) and 7.4MT/ha (control for N). The effect of potassium application was to increase yields by up to 86%, but nitrogen tended to stimulate vine growth at the expense of the tuber.

14.19 In a series of trials at Dala, Gollifer<sup>(17)</sup> found unfertilised sweet potato yields to range widely, from around 0.25MT/ha to 24MT/ha. Yields in general were the order of 5MT/ha, which was estimated to be around half the typical North West Guadalcanal yield of 9.97MT/ha. Yield variability could not be attributed to variety or soil type, but a trend related to intensity of cropping did appear:

Effect of Recent Land History on Sweet Potato Yields (MT/ha):

land history	yield (MT/ha)
continuous cropping	3.51
0 - 4 years fallow	4.77
5 - 9 years fallow	6.03
more than 10 years fallow	9.29

Source: Gollifer (1969)



14.20 It was concluded that sweet potato and other root crops are demanding of, and remove large quantities of, potassium from the soil. A fallow-burn cycle is therefore essential to replenish soil fertility by making potassium available to shallow-rooted crops. It was considered that deep rooting trees may act as nutrient pumps, but the only practical way of shortening fallow periods was<sup>(17)</sup> considered to be the application of potassium fertiliser.

14.21 Bathgate<sup>(18)</sup> found also that yields vary according to soil fertility and growing time, as well as species and density of planting. In West Guadalcanal he quotes sweet potato yields of 7.16MT/ha after 20 years of fallow and 9.36MT/ha after 8 years of fallow, but based on a single sub-plot observation only in each case.

14.22 On the weather coast of Guadalcanal Chapman and Pirie<sup>(19)</sup> studied the relationship between yields and cropping, and found yields to be high in comparison to studies elsewhere:

Sweet Potato Yield (MT/ha) - Weather Coast, Guadalcanal

successive crops	Ghauvalisi	Sughu	Hatare/Poinaho
1	41.67	18.08	17.82
2	15.31	10.54	9.79
3		10.29	3.79

Source: Chapman and Pirie (1974)

14.23 In the 1974-75 Agricultural Survey<sup>(5)</sup> the mean yield of sweet potato was 15.7MT/ha, but this was felt to be an over-estimate.

14.24 More recent research provide further information on sweet potato yields, but results exhibit considerable variability across seasons and due to other causes:

trial	yield MT/ha		notes
	gross	marketable	
improved cultivars	17.9	14.5	25 obs
control	11.2	6.7	1 obs
dry season corn intercropping	15.9	7.1	135 days to harvest
	18.5	12.0	165 days to harvest
wet season corn intercropping	5.9	1.5	135 days to harvest
	11.0	3.4	165 days to harvest
dry season weevil control	15.3		no effect from insecticide
wet season weevil control	8.19	6.37	

Source: Research Department Annual Report 1984<sup>(14)</sup> and 1985<sup>(13)</sup>

14.25 No yield observations on sweet potato were made in the present survey.

14.26 Smallholder sweet potato yields of usable crop are estimated in the present report to be 8MT/ha under long fallow of 8 years or more - falling to 5MT/ha for fallow of 4 to 8 years, and 3.5MT/ha for short fallow cropping.

#### d) TARO:

14.27 Taro yields in the literature are highly variable. Frazer<sup>(15)</sup> found Colocasia esculenta to yield 8.94MT/ha in North Malaita, based on 10 observations. Gollifer<sup>(16)</sup> on the Dala Series in Malaita found yields of 4.0MT/ha for unfertilised taro, which increased to 6.0MT/ha with 168kg/ha potassium fertiliser applied. Gollifer<sup>(17)</sup> also quotes widely ranging unfertilised taro yields of 1.00 to 10.80MT/ha on experimental plots. In a spacing trial in Guadalcanal at Tenaru on which fertiliser was applied, the net undamaged taro yield for densities of 2,000 to

4,000 plants/ha was around 5MT/ha, with 30% loss due to corm damage<sup>(14)</sup>. On the same site a high intensity inputs and management trial to investigate leaf blight yielded around 9MT/ha marketable corms<sup>(14)</sup>. The control yield in a 1985 taro beetle trial at Tenaru was 3.49MT/ha<sup>(13)</sup>. Tioti (1967) estimated taro yields to be 12.6MT/ha<sup>(25)</sup>, but Gollifer (1970) quotes yields of 4.7MT/ha<sup>(26)</sup>.

14.28 No taro yields were obtained in the present survey. Smallholder taro yield in the present report is estimated to be 5MT/ha.

e) YAM:

14.29 In North Malaita Frazer<sup>(15)</sup> found yam yields of 5.16MT/ha for Dioscorea alata. Gollifer<sup>(17)</sup> quotes unfertilised yam yields of 6.03MT/ha to 30.38MT/ha at Dala experimental station on Malaita. In 1984 an experiment to compare the yields of 18 yam cultivars was conducted at Tenaru in Guadalcanal<sup>(14)</sup> in which the cultivars with high resistance to dieback yielded around 14 to 18MT/ha, with the highest resistance cultivar yielding 24MT/ha. Susceptible cultivars produced yields as low as 2MT/ha. Maeinia<sup>(27)</sup> quotes very high yields of 50 - 63MT/ha for Malaita.

14.30 Smallholder yam yields are likely to be higher than those of sweet potato given that they tend to be planted on newly opened sites and the yield appearance is generally good. Long term fallow is expected to yield 10MT/ha, fallow of 4-8 years to yield 6MT/ha and short fallow systems to yield 4MT/ha.

f) PANA:

14.31 Frazer<sup>(15)</sup> quotes a for North Malaita, where on one observation only of Dioscorea esculenta produced a yield of 11.52MT/ha<sup>(14)</sup>. Fertilised cultivar trials at Dodo Creek Research Station in 1984 yielded 16.2MT/ha marketable tubers out of a total yield of 27.7MT/ha. 1983 results were higher, with 43.7MT/ha marketable tubers out of a total yield of 52.9MT/ha. The difference was believed to be due to inadequate fertiliser in 1984. In 1985 the mean fertilised yield of 8 cultivars was 24.3MT/ha marketable tubers<sup>(13)</sup>.

14.32 Smallholder pana yields are expected to be similar to yam yields - of 10MT/ha under long fallow, 6MT/ha under 4-8 years fallow, and 4MT/ha under short fallow.

g) CASSAVA:

14.33 Fertilised cassava in a time of harvest trial at Dodo Creek in Guadalcanal<sup>(13)</sup> yielded 23.8MT/ha after 9 months and 27.8MT/ha after 12 months. In a fertilised germplasm collection trial on the Fataolo land system on Malaita<sup>(17)</sup> 17 cultivars ranged from 7.5 to 65.8MT/ha, with 50% above 40MT/ha<sup>(28)</sup>.

14.34 Cassava is a fairly important crop in the survey area. Smallholder yields in the present report are estimated to be 10MT/ha.

h) MAIZE:

14.35 Gollifer<sup>(16)</sup> quotes unfertilised maize yields of 1.90MT/ha on Dala soils in Malaita, but yields of 5.58MT/ha when fertilised with NPK. Further unfertilised maize yield data from Dala<sup>(17)</sup> range from 1.55MT/ha to 2.13MT/ha.

14.36 Smallholder maize yields in the present report are estimated to be 1.8MT/ha.

i) GROUNDNUT:

14.37 Gollifer quotes unfertilised groundnut yields in the range 527kg/ha to 1,278kg/ha from Dala in Malaita.

14.38 Smallholder groundnut yields in the present report are estimated to be 600kg/ha.

k) SUMMARY OF YIELDS:

14.39 Crop yields derived from the survey and secondary sources are necessarily imprecise because of the complexity of smallholder farming systems. Diverse crop mixtures, with varying crop densities and differing site conditions do not lend themselves to a simple analysis of crop yields or smallholder production. Crop yields in the literature are generally for pure stand crops, or very simple mixtures - under controlled or even modified conditions. There is then a need to study smallholder production under more realistic conditions, as is part of the on-going programme of the Agricultural Economics Section. In the meantime, a "best estimate" of typical smallholder yields in the project area is presented in table 14.5.

Table: 14.5  
SMALLHOLDER CROP YIELDS

crop	condition	yield kg/ha
coconut	copra equivalent	800
cocoa	dry beans	600
sweet potato	> 8 years fallow	8,000
	4 - 8 years fallow	5,000
	< 4 years fallow	3,500
taro		5,000
yam	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
pana	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
cassava		10,000
maize		1,800
groundnuts		600



## Chapter: 15

### SMALLHOLDER PRODUCTION

15.1 Under the Rural Services "Project Beneficiary Monitoring and Evaluation" undertaken by the Statistics Office, gross crop offtake and other primary production were measured on six of the Rural Development Centre sites. The closest site on Malaita is at Afio. Results may not be representative of conditions in South Auki and so are not presented here.

15.2 From table 9.2 the average root crop area in the survey area is 0.204ha of which sweet potato is dominant on 0.167ha. All crops occur in complex mixtures, so that simple cropping patterns can only be used as a first approximation for the actual crop coverage.

15.3 Table 15.1 is a summary of available production data from the farming systems survey. It is not possible to directly relate aggregate production data to average cropping patterns until a more detailed analysis of smallholder production is available.

Table: 15.1  
SMALLHOLDER PRODUCTION SUMMARY

commodity	area (ha)	growing period (months)	annual production (kg)
sweet potato	0.167	4.6	
cassava	0.008	7.5	
yam	0.004	6.5	
pana	0.018	7.2	
taro	0.007	7.8	
breadfruit			
banana			

Source table:                      9.2                      11.3

## Chapter: 15

### SMALLHOLDER PRODUCTION

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banana			

Source table:                      9.2                      11.3

## Chapter: 16

### LABOUR

16.1 With little or no cash inputs applied the main component in the socio-economy of smallholder agriculture is labour. Table 16.1 presents an overview of labour constraints expressed by farmers. The first part of the table shows the frequency of gardens affected and is expressed in terms of area affected in the second part. Labour constraints are illustrated in diagram 16.1.

Table: 16.1

#### LABOUR CONSTRAINTS

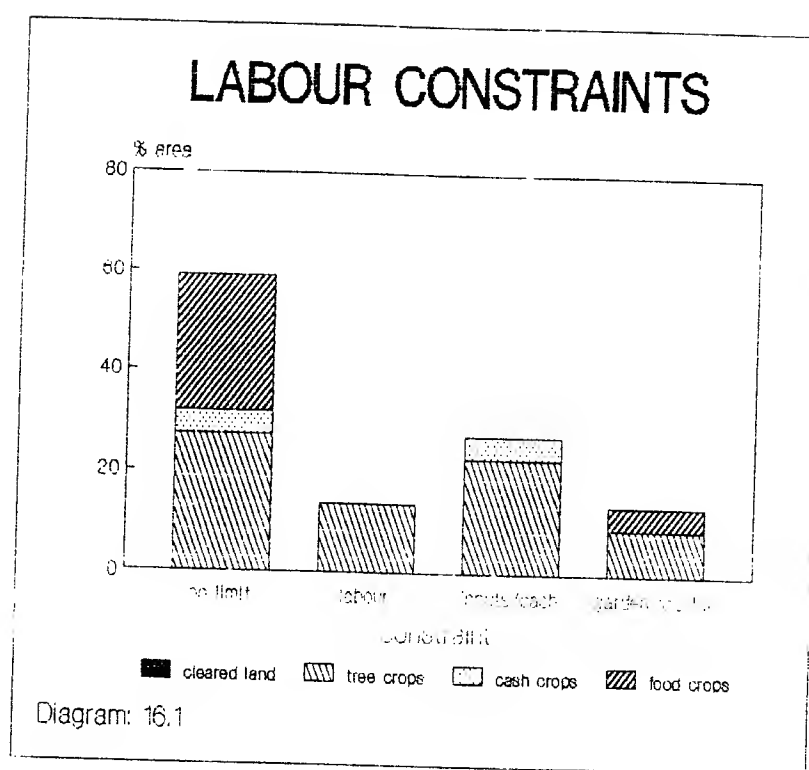
i) Labour Constraints by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		11	2	41	54
lack of labour			1		1
lack of inputs/cash		3	2		5
lack of labour + cash		2	1		3
garden too far from house		1		8	9
garden too far + labour					
garden too far + cash					
too far + labour + cash					
total by crop type		17	6	49	72

ii) Labour Constraints by % cultivated area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		27	5	27	59
lack of labour					
lack of inputs/cash		9	5		14
lack of labour + cash		14			14
garden too far from house		9		5	14
garden too far + labour					
garden too far + cash					
too far + labour + cash					
total by crop type		59	9	32	100

Note: The table of % area is only approximate due to rounding small numbers



16.2 75% of gardens on 59% of the farmed area have no important constraints, due to a high proportion of very small holdings and a small overall mean holding size. The dominant constraints are on tree crops, and the dominant constraint is of inputs and cash rather than labour or distance of gardens from the household. A summary of constraints expressed as percentages of gardens by each crop type [and in brackets as the corresponding % area] is as follows:

limitation	<----- garden type ----->					
	tree crops		short term		food crops	
			cash crops			
No limitation	64	[46]	33	[50]	84	[84]
Lack of labour	12	[24]	17	[ ]		
Lack of inputs	30	[39]	50	[50]		
Garden too far	6	[15]		[ ]	16	[16]

16.3 Table 16.2 summarises the labour requirements of the average holding, derived from individual plot labour studies presented in annex 2. The table is a "model" budget representing the average of complex and diverse holdings. Individual crop budgets in annex 2 may be used to construct farm budgets for hypothetical holdings, but caution should be exercised where there are few observations. Labour days in budgets presented here are based on actual hours worked per day, which are quite variable. Again, tables in annex 2 may be used to convert work hours into "standard" work days if required. Since table 16.2 represents the average holding, crops which comprise only minor mixtures in cropping patterns do not appear in the summary labour budget.

16.4 The table shows the labour requirement of each agricultural operation according to crop, which may be a pure stand or more commonly the dominant crop in a mixture. Agricultural operations cover: land clearance; cultivation; planting; first, second and third weeding; and harvesting. For some crops - notably, but not exclusively, trees - there may be additional operations such as pruning or thinning which do not easily fall within the standard classification. Two general categories of establishment and maintenance operations are therefore included. Such a classification provides good coverage for most activities and allows diverse crops to be handled in a standard manner.

16.5 In the interpretation of labour budgets it should be remembered that only tree cropping farmers will require labour on tree crops while non-tree cropping farmers will not require any. Labour budgets are also presented on the basis of labour input "when operations are performed". Adjustment is not made to the labour input to take account of operations which are omitted. By referring to annex 2 adjustments may be made to budgets based on different assumptions about management intensity. Incorporating this into the present analysis would considerably increase the complexity of presentation and introduce ambiguity into the results.

Table: 16.2

## ANNUAL LABOUR INPUT BY HOLDING

	<----- work days per year ----->					<- % contribution ->			labour cost (SIS)
	<----- per holding ----->		per ha		average	men	women	paid	
	men	women	paid	total					
i) Land Clearance									
Cleared Land	1	1		2	259	50	50		1
Cocoa	5	5		10	65	50	50		
Cabbage					44				
Vegetable					273				
Fruit Crops			4	4	26			100	13
Sweet Potato	7	12	1	20	119	35	60	5	2
Taro	1			1	94	100			
Yam					26				
Pana	1	1		2	92	50	50		1
Cassava	1	1		2	187	50	50		
Total holding	16	20	5	41	123	39	49	12	17
ii) Cultivation									
Cleared Land									
Cocoa									
Cabbage									
Vegetable					328				
Fruit Crops	2	1		3	23	67	33		
Sweet Potato	13	11	1	25	149	52	44	4	3
Taro	1			1	105	100			
Yam					53				
Pana	1			1	70	100			
Cassava	1			1	160	100			
Total holding	18	12	1	31	127	58	39	3	3
iii) Planting									
Cleared Land					180				
Cocoa	8			8	180	100			
Cabbage					180				
Vegetable					81				
Fruit Crops	2	1		3	7	67	33		
Sweet Potato	7	15		22	88	32	68		
Taro	1			1	574	100			
Yam					436				
Pana	1			1	175	100			
Cassava		1		1	177		100		
Total holding	19	17		36	310	53	47		

# ANNUAL LABOUR INPUT BY HOLDING (continued)

<----- work days per year ----->    <- % contribution ->    labour  
 <----- per holding ----->    per ha                      cost  
 men   women   paid   total   average    men   women   paid   (SI\$)

## iv) Establishment

Cleared Land									
Cocoa									
Cabbage									
Vegetable									
Fruit Crops									
Sweet Potato									
Taro									
Yam									
Pana									
Cassava									

Total holding

## v) Maintenance

Cleared Land									
Cocoa	1	3	1	5	31	20	60	20	6
Cabbage									
Vegetable									
Fruit Crops	4	7	3	14	100	29	50	21	8
Sweet Potato									
Taro									
Yam									
Pana									
Cassava									

Total holding

5    10    4    19    57    26    53    21    14

## vi) First Weeding

Cleared Land									
Cocoa					3				
Cabbage					66				
Vegetable									
Fruit Crops	4	2		6	42	67	33		
Sweet Potato	1	16		17	101	6	94		
Taro					84				
Yam					26				
Pana		1		1	45		100		
Cassava		1		1	141		100		

Total holding

5    20    25    81    20    80

# ANNUAL LABOUR INPUT BY HOLDING (continued)

<----- work days per year ----->    <- % contribution ->    labour  
 <----- per holding ----->    per ha    cost  
 men    women    paid    total    average    men    women    paid    (SI\$)

## vii) Second Weeding

Cleared Land									
Cocoa				3					
Cabbage									
Vegetable									
Fruit Crops	4	2	6	42		67	33		
Sweet Potato		20	20	119			100		
Taro				81					
Yam									
Pana									
Cassava									
Total holding	4	22	26	194		15	85		

## viii) Third Weeding

Cleared Land									
Cocoa									
Cabbage									
Vegetable									
Fruit Crops	13		13	94		100			
Sweet Potato									
Taro				83					
Yam									
Pana									
Cassava									
Total holding	13		13	24		100			

## ix) Harvesting

Cleared Land									
Cocoa	5	4	9	54		56	44		
Cabbage				166					
Vegetable									
Fruit Crops	5	19	24	178		21	79		
Sweet Potato		144	144	863			100		
Taro		7	7	976			100		
Yam									
Pana									
Cassava		7	7	837			100		
Total holding	10	181	191	757		5	95		



16.6 Labour expenditure is very low, especially among men. There may be a certain amount of under-reporting resulting from difficulties experienced in this survey but low levels of labour expenditure are also related to the relative unimportance of coconuts in farming systems, the small size of holdings, and the importance of non-agricultural income earning activities. Coconuts are unrepresented in the labour budgets and the main component of labour budgets in root crops. On land clearance cocoa accounts for 24% of labour expended, requiring 10 work days per year. Root and fruit crops account for a further 70% of labour expended, requiring 29 days mainly on sweet potato. Of 41 work days, men contribute 39%, women 49% and paid labour accounts for 12%.

16.7 Land cultivation requires 31 days, mainly on root crops. Men contribute 58%, women contribute 39% and hired labour accounts for 3%.

16.8 22% of the labour expended in planting is on cocoa, accounting for 8 work days per year, with a further 28 work days, or 78% of the labour budget on root and fruit crops. Of 53 work days per year required on planting men contribute 53% while women contribute 47%. Women perform most of the planting of root crops and men provide all of the labour in the planting of cocoa.

16.9 19 days per year are expended on the maintenance of cocoa and pineapples, for which men contribute 26% of labour, women contribute 53% and 21% is accounted for by hired labour.

16.10 25 work days are spent on the first weeding of root and fruit crops. Women account for most of the labour on first weeding and men contribute 20%

16.11 26 work days are spent on the second weeding of crops, which is mainly on sweet potato but also on pineapple. Men provide 15% of the labour on second weeding and women provide 85%. An additional 13 days are expended on the third weeding of pineapples by men.

16.12 Harvesting is the major operation requiring 191 work days, almost entirely on fruit and root crops. Only 5% of harvesting labour is provided by men, on cocoa and fruit crops. Women perform 95% of harvesting labour.

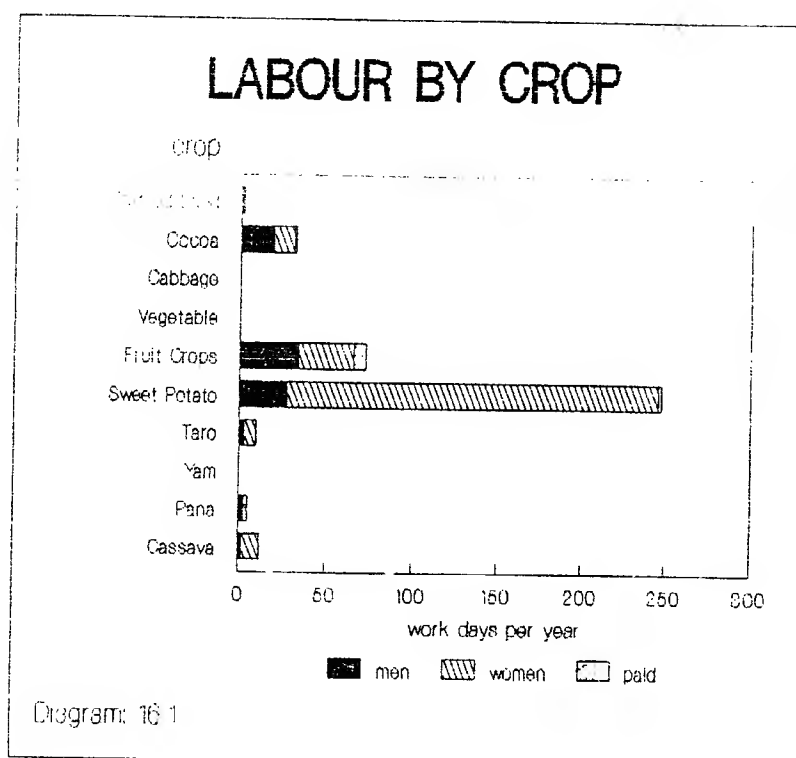
16.13 Overall men provide 24% of labour and women provide 74%, with 3% of farm labour accounted for by hired labour. Table 16.3 presents a summary of labour by crop and by operator.

16.14 There are 382 work days per year required on an "average" holding of which 90 are provided by men, 282 by women and 10 by hired labour. The average adult man in the household spends 55 days working on the holding and the average adult woman spends 156 days.

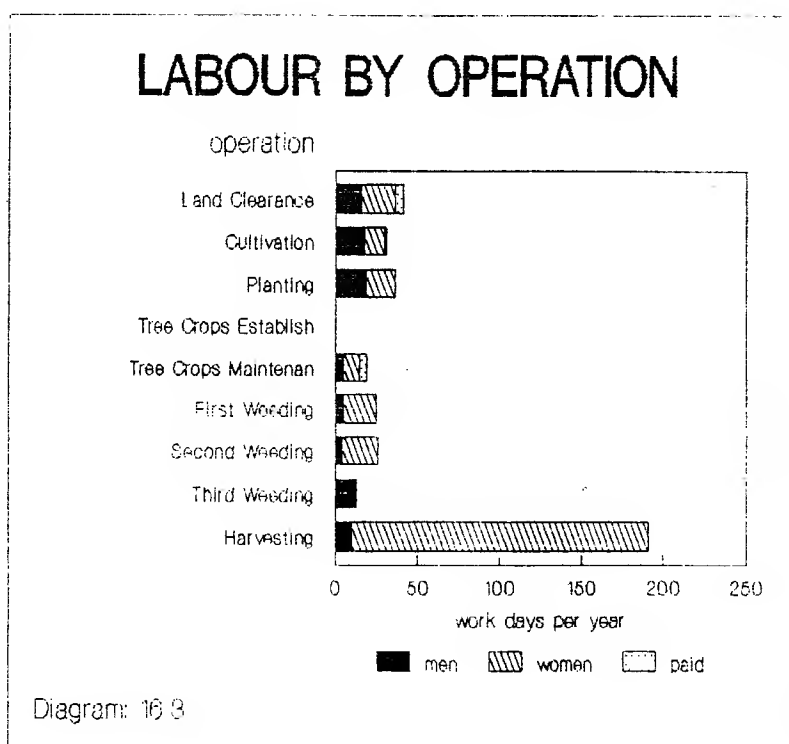
Table: 16.3  
SUMMARY OF LABOUR INPUT

	<----- work days per year -----> <----- per holding ----->					<- % contribution ->			labour cost
	men	women	paid	total	per ha average	men	women	paid	(\$/\$)
i) By Crop									
Cleared Land	1	1		2		50	50		1
Cocoa	19	12	1	32		59	38	3	6
Cabbage									
Vegetable					682				
Fruit Crops	34	32	7	73	512	47	44	10	21
Sweet Potato	28	218	2	248	1439	11	88	1	5
Taro	3	7		10	1997	30	70		
Yam					541				
Pana	3	2		5	382	60	40		1
Cassava	2	10		12	1502	17	83		
All Crops	90	282	10	382		24	74	3	34
ii) By Operation									
Land Clearance	16	20	5	41		39	49	12	17
Cultivation	18	12	1	31		58	39	3	3
Planting	19	17		36		53	47		
Tree Crops Establishment									
Tree Crops Maintenance	5	10	4	19		26	53	21	14
First Weeding	5	20		25		20	80		
Second Weeding	4	22		26		15	85		
Third Weeding	13			13		100			
Harvesting	10	181		191		5	95		
All Operations	90	282	10	382		24	74	3	34
Available labour units	:1.65	1.81							
Days per unit labour	: 55	156	10						

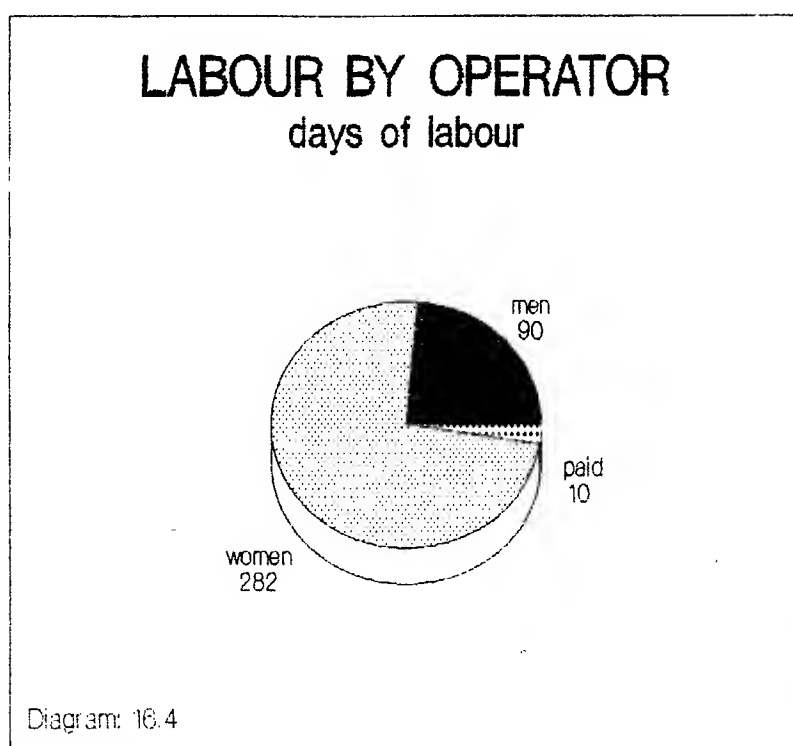
16.15 Labour by crop is illustrated in diagram 16.2. Cocoa accounts for 8% of the holding labour budget. Sweet potato accounts for 65% and pineapple accounts for 19%.



16.16 Labour by operation, in which harvesting is dominant, is illustrated in diagram 16.3. Men and women share most operations but women provide most of the labour, especially on harvesting. Of the annual labour budget of 382 days, land clearance accounts for 11% of labour expended, cultivation accounts for 8%, planting 9%, establishment and maintenance 5%, weeding or brushing 17% and harvesting 50%.



16.17 Diagram 16.4 illustrates the contribution from men, women and hired labour. Men contribute 24% of labour on farm, women provide 74% and hired labour accounts for 3%.



## Chapter: 17

### CROP AND FARM BUDGETS

17.1 It is not possible at this stage to produce comprehensive crop and farm budgets because of the complexity and diversity of cropping patterns, and production data are as yet incomplete. The main elements are available and a summary of information on cropping patterns, production and labour is presented in Table 17.1.

Table: 17.1  
ELEMENTS OF A FARM BUDGET

main crop in mixture	area (ha)	annual production (kg)	annual labour	
			work days	cost (SIS)
a Cleared Land	0.008		2	1
b Coconut	0.227			
c Cocoa	0.162		32	6
z Coconut and Cocoa	0.110			
d Pasture				
e Grain Crops				
f Beans				
g Cabbage	0.003			
h Vegetables	0.001			
i Spices				
j Fruit Crops	0.137		73	21
k Fruit trees				
l Banana				
m Citrus trees				
n Nut trees				
o Sugar cane				
p Food/building tree				
q Tobacco				
r Sweet Potato	0.167		248	5
s Taro	0.007		10	
t Yam	0.004			
u Pana	0.018		5	1
v Cassava	0.008		12	
w Other root crop				
Total	0.850		382	34
Table reference	9.2	not available	16.3	16.3

## Chapter: 18

### CASH CROP PROCESSING

18.1 Table 18.1 presents a labour budget for the production of copra based on only one observation. The labour composition is entirely family labour.

18.2 Copra manufacture requires 25 work days per annum to produce 137kg copra, or one work day per 6kg copra produced. 10 work days are spent on picking and shelling the nuts which account for 39% of the total production time. Firewood collection takes 2 days or 8% of the time; and drying, bagging and transport take 13 days or 53% of the time. The annual labour input is illustrated in diagram 18.1.

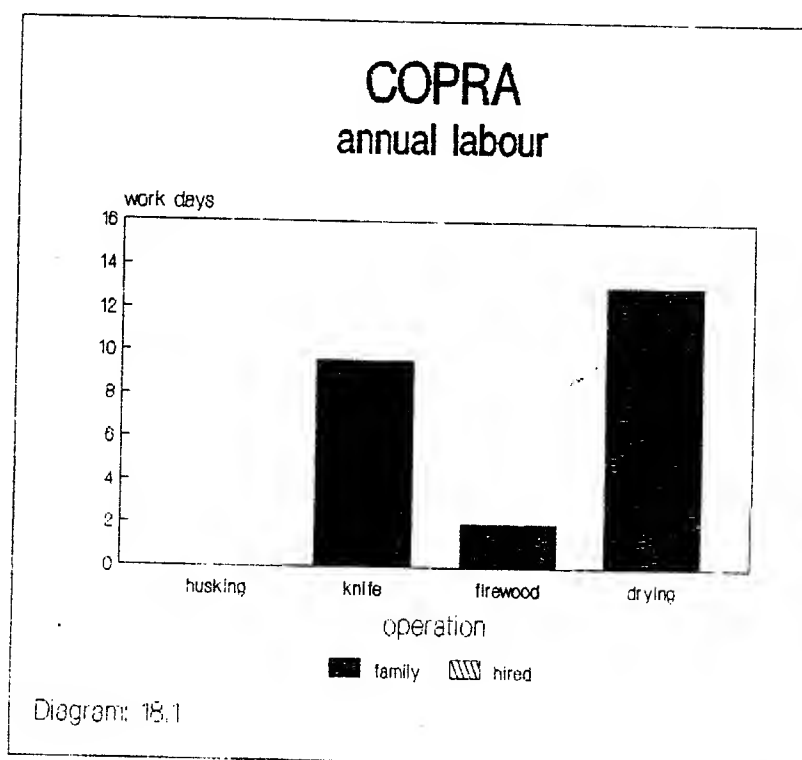


Table: 18.1

## ANNUAL COPRA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost (\$c)	work days	
HUSKING	picking, heaping husking transport breaking shelling						
total							
COPRA KNIFE	picking, heaping	24.0	4.0			4.0	16
	axing + copra knife	16.0	2.0			2.0	8
	transport	28.8	3.6			3.6	15
total		68.8	9.6			9.6	39
FIREWOOD	collection transport collection + transport	16.0	2.0			2.0	8
total		16.0	2.0			2.0	8
DRYING	drying bagging transport	120.0 12.0 1.0	10.0 2.0 1.0			10.0 2.0 1.0	41 8 4
total		133.0	13.0			13.0	53
TOTAL		217.8	24.6			24.6	100
% labour by type of labour		100		100		100	

copra grade	quantity of copra produced (kg)	
	per annum	per work day
Grade 1	137	6
Grade 2		
Grade 3		
Ungraded		
total	137	6

Number of observations =

1



18.3 The gross margin for copra production is summarised in table 18.2. From an annual production of 137kg valued at the prevailing price of 33 cents per kilo the gross return is SI\$45. Inputs costs from bags and twine amount to SI\$2.04. The net income is SI\$43 which, at a requirement of 25 household labour days, represents a net return to labour of SI\$1.75 per household work day.

Table: 18.2  
COPRA GROSS MARGIN

Annual production (kg)	137
Price per kilogram (SI\$)	0.33
Gross return (SI\$)	45
Inputs cost (SI\$)	2.04
Labour cost (SI\$)	
Net return (SI\$)	43
Household labour days	25
Copra production per household work day (kg)	5.6
Net return per household work day (SI\$)	1.75

Inputs costs: Sacks @ SI\$1.00 per new sack;  
Average packed weight 70kg = 2 sacks = SI\$2.00.  
Twine @ SI\$1.00 per hank of 50 strings = SI\$0.04.

18.4 Table 18.3 presents the budget for cocoa production undertaken by 6 sampled farmers.

Table: 18.3

ANNUAL COCOA PRODUCTION AND LABOUR EXPENDITURE

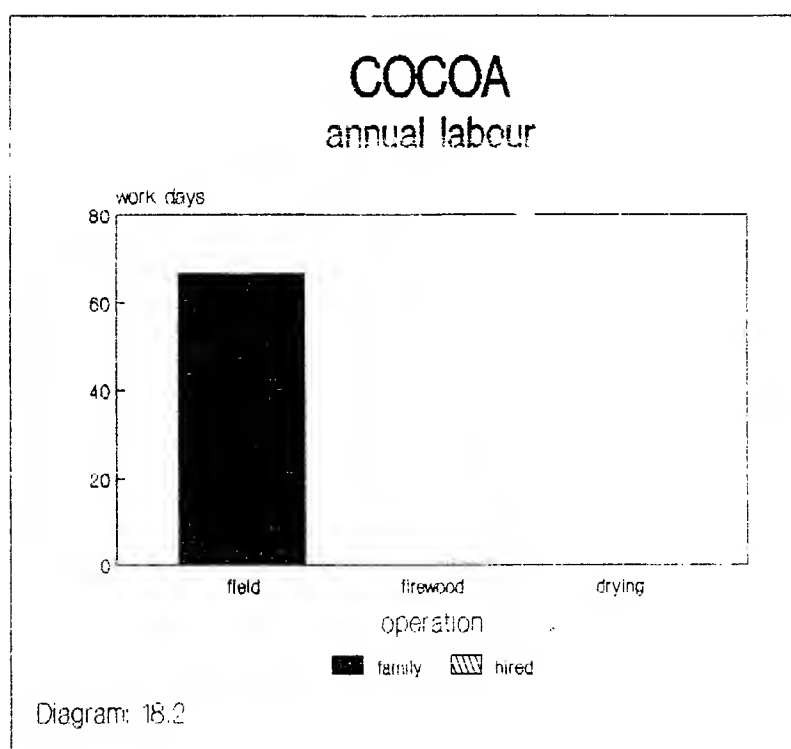
Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost (\$c)	work days	
FIELD	harvesting	96.8	22.0			22.0	33
	breaking pod	157.5	32.3			32.3	48
	transport	12.3	12.3			12.3	18
	total	266.7	66.7			66.7	100
FIREWOOD	collection						
	transport						
	collection + transport						
	total						
DRYING	harvesting						
	drying						
	bagging						
	transport						
	total						
TOTAL		266.7	66.7			66.7	100
% labour by type of labour			100			100	

cocoa	quantity of cocoa produced (kg)	
	per annum	per work day
Wet beans	1,480	22
Dry Beans		
total	1,480	22.2

Number of observations =

6

18.5 67 family work days were expended in the production of 1,480kg cocoa green beans. Labour expenditure in the production of cocoa is illustrated in diagram 18.2.



18.6 The gross margin for cocoa is shown in table 18.4. An annual production of 1,480kg of cocoa at the prevailing price of SI\$0.70 per kilo green beans provides a net return of SI\$1,036, representing a return to labour of SI\$15 per family day worked.

Table: 18.4  
COCOA GROSS MARGIN

Annual production green beans (kg)	365
Price per kilogram (SI\$)	0.70
Gross return (SI\$)	265
Annual production dry beans (kg)	
Price per kilogram (SI\$)	1.70
Gross return (SI\$)	
Green and dry beans gross return (SI\$)	256
Inputs cost (SI\$)	6.12
Labour cost (SI\$)	
Net return (SI\$)	250
Household labour days	13
Cocoa production per household work day (kg)	28
Net return per household work day (SI\$)	19.96

Inputs costs: Sacks @ SI\$1.00 per new sack;  
Average packed weight 65kg = 6 sacks = SI\$6.00;  
Twine @ SI\$1.00 per hank of 50 strings = SI\$0.12.

## Chapter: 19

### MARKETING

19.1 Table 19.1 presents a summary of marketing data collected in the survey, listing crops marketed against the number of observation recorded. The mean weight marketed is recorded, the time taken to go to market and back, the number of times the commodity is marketed per year, and the number of people involved in marketing. These are grouped under the heading of "marketing" details.

19.2 Marketing costs are recorded under the headings of freight or transport costs, fares for people involved in marketing, and market tax which may be imposed at the point of sale.

19.3 Revenues are possible where wages are earned, for instance from selling other farmers' produce and from the sale of crops. It is often difficult for sellers to specify costs and revenues, and in such cases data have to be treated as "missing". Thus the number of observations for crop sales may be lower than those for marketing data.

19.4 Table 19.2 is a transformation of the raw marketing data into an "average" annual marketing budget. The data are incomplete because of difficulties in recalling weights sold and marketing revenues. It is presented not as a model marketing budget, but as a data set to provide as much information on marketing as possible, albeit with gaps.

19.5 The two right-most columns show the net marketing revenue by crop and by household. The "net marketing revenue by crop" is the net return from sales after deducting costs. It is not the average income from crop sales since revenue may be negative where income data are missing or as a result of the double counting of transport costs when freight expenses are shared among several crops.

19.6 The "net marketing revenue per household" is the average household earnings taking account of the proportion of households selling each type of crop, but based on the limitations of the crop revenue data.

Table 19.1  
MARKETING TIME AND CROP PRICES

Basic Marketing Data:

		marketing			costs			revenues		
	number of obs	mean weight marketed and back per year	time to market days	times (times)	freight/ of transport cost	fares for people	market tax	wages earned	crop sale price	crop sale obs
	(obs)	(kg)	(days)	(times)	(\$/kg)	(\$/kg)	(\$/kg)	(\$/kg)	(\$/kg)	(obs)
ALL CROPS	24	74	1.3	13	4.60	6.93	0.40	1.09	1.09	24
COCOA/COCONA										
Cocoa	1	137	1.0	3	4.00	4.00			0.44	1
Coconut	7	81	0.4	18	0.14	0.14			0.54	7
ROOT CROPS										
Sweet Potato	4	66	0.8	4	5.00	1.50	0.13		0.68	4
Taro Common	1	30	1.0	1		1.00	0.50		0.70	1
BEANS										
Long Bean	1	5	1.0	24	0.50	1.30	0.50		4.00	1
CABBAGE										
Hibiscus Cabbage	1	10	1.0	36	0.50	1.30	0.50		0.42	1
VEGETABLES										
Shallot	1	5	1.0	24	0.50	1.30	0.50		1.50	1
Tomato	1	5	1.0	20	0.50	1.30	0.50		3.33	1
FRUIT CROPS										
Pineapple	7	108	2.5	11	11.00	19.50	0.88		1.33	7
Number of households										
										26

Table 1.

## Annual Marketing Budget:

[illegible]

19.7 Table 19.3 shows the time taken to different markets and the type of crop sold at each market. The classification of markets is subject to local interpretation, where "central" would generally be the provincial capital.

Table: 19.3  
MARKET LOCATION

market location:	local	inter- mediate	central	Honiara	trading ship	% obs	number of obs
i) Time taken to market produce							
time taken to go to market and back (days)	(% observations)						
0 - .5	16	4				20	5
.5 - 1	16	4	48			68	17
1 - 2							
2 - 5				8		8	2
5 - 10				4		4	1
> 10							
% observations	32	8	48	12		100	
number of observations	8	2	12	3		25	25
mean time (days)	1	1	1	5			1.75
ii) Crops sold at different markets							
	(% observations)						
COCONUT/COCOA Copra			4			4	1
Cocoa (green)	20	8				28	7
ROOT CROPS Sweet Potato	12		4			16	4
Taro Common			4			4	1
BEANS Long Bean			4			4	1
CABBAGE Hibiscus Cabbage			4			4	1
VEGETABLE Shallot			4			4	1
Tomato			4			4	1
FRUIT CROPS Pineapple			20	12		32	8
% observations	32	8	48	12		100	
number of observations	8	2	12	3			25



19.8 Table 19.4 summarises crop price perception and sale volumes.

Table: 19.4

CROP PRICE PERCEPTION AND SALE VOLUMES

		<---- sale price ---->			<----- sale volume ----->			number of
		poor	average	good	little	average	more than usual	obs
COCONUT	Copra			100		100		1
	Cocoa (Green Beans)	14	86		29	71		7
ROOT CROPS	Sweet Potato	25		75	75	25		4
	Taro Common		100			100		1
BEANS	Long Bean		100			100		1
CABBAGE	Hibiscus Cabbage		100			100		1
VEGETABLE	Shallot		100			100		1
	Tomato		100			100		1
FRUIT CROPS	Pineapple		63	38		88	13	8
Number of observations		2	16	7	5	19	1	25

19.9 Sale volumes and prices are generally regarded as "average".  
Local market prices from Auki are listed below:

<u>crop/commodity</u>	<--- price SI\$ in 1988 --->							
	<u>at 25 May</u>		<u>at 15 October</u>					
sweet potato	.29	.31	.97	.38	.62			
taro common			.50	.67				
Hong Kong	.29		.32					
pana	.25	.32						
yam	.20	.23						
coconut dry	.08		.13					
green	.33		.27					
banana sweet	.17		.25					
cooking	.25		.43					
pumpkin	.20		.29					
melon			.71	.83				
pumpkin tips			.46					
taro leaf			.67					
paw paw			.31					
pineapple	.19		.36	.50	.38	.46	.50	.44
hibiscus cabbage	.15		.47	.67	.27			
chinese cabbage			.31					
capsicum pepper			1.00	4.00				
tomato			.33					
watercress			.29					
shallot			1.00					
snake bean			.40					
long bean	1.00							
wing bean	.40							
cucumber	.15							
peanuts	4.00		4.00	3.14				
mangrove fruits			.22					
sugar cane	.11							
ngali nut	.50		2.00					
betel nut	.50		2.00	2.00				
leaf			3.00					
stick			1.00					
tobacco			10.00					

19.10 Table 19.5 summarises marketing problems. To the right of the table are the proportion of cases by severity of problem. These are combined with crop type in the body of the table to show the "index of severity". In this index "no problem" is weighted "0", "slight problem" is weighted "0.5", and "severe problem" is weighted "1.0". Thus if all cases registered a severe problem the index would be "1.0".

Table: 19.5  
MARKETING PROBLEMS

Number of observations = 25

	<----- crop type ----->			<----- severity of ----->		
	coconut and cocoa	root crops	other crops	none	slight	severe
	(index of severity)			(% cases)		
terrain too difficult			0.1	84	8	8
distance too great	0.0	0.0	0.2	64	12	24
not enough time/labour	0.0	0.0	0.2	64	20	16
transport cost too high	0.0	0.0	0.4	44	12	44
low price at market	0.0	0.1	0.3	40	44	16
lack of transport		0.0	0.2	72	20	8
unreliable transport		0.0	0.1	80	8	12
risk of not selling enough		0.0	0.4	48	24	28
crop damage in transit			0.3	56	20	24
administrative restrictions			0.1	84	16	
quarantine control				100		
other problem				100		

Note: "Index of Severity is a weighted summary of severity of marketing problems.  
It falls in the range 0 to 1 where 0.0 = no marketing problem  
0.5 = slight marketing problem  
1.0 = severe marketing problem

19.11 Crop marketing is important in the survey area, with relatively high levels of income earned in comparison to other areas under study. The two major income earning crops are pineapple and cocoa and most marketing is conducted locally or in Auki, although about one third of pineapple sales are to Honiara. The main marketing problems are with pineapple where transport difficulties and consequent marketing risks and costs are important constraints.

## **Annex: 1**

### **CROP NAMES AND CODES**

A1.1 The following list describes the hierarchical coding sequence used by AES in farming systems surveys to describe crop types. The list may be added to by inserting other crops of interest within the appropriate category.

A1.2 At the garden level only broad distinctions are made between cleared land, tree crops, short term cash crops, and food crops. Only single digit numeric codes are permitted at this level and these do not distinguish between crop type or mixtures. They do, however, provide important information about the structure of the holding. Code "1" for instance specifies "tree crops".

A1.3 At the plot level alphabetical codes are used to describe crop mixtures. These are used to describe cropping patterns and the analysis of labour by crop. Letter codes are strung together so there is no pre-set limit on the complexity of mixtures described. Some simplification is introduced within the code categories themselves. The dominant crop is listed first and other crops are listed to the right in decreasing order of importance. The string code then takes the form of an alphabetical "number", where the most significant characters are to the left and the least significant to the right. For instance "a" specifies "cleared land", while "rvgfl" specifies a mixture in decreasing order of importance of "sweet potato, cassava, cabbage, beans, banana".

A1.4 At the yield and marketing levels it is necessary to specify exactly the crop under study, and so a unique three-digit numeric code is assigned to each crop. The list need not be complete and may be added to as necessary since "spare codes" are available. For instance "613" specifies "pineapple".

Table: A1.1  
CROP NAMES AND CODES

garden		plot	yield and marketing		scientific name
code	name	code	code	name	
0	cleared	a	100	CLEARED (unplanted)	
1	tree crops	b	200	COCONUT	<u>Cocos nucifera</u>
			210	Local Tall	
			211	Rennel	
			212	Dwarf Hybrid	
			219	Other	
			250	Copra	
1	tree crops	c	300	COCOA	<u>Theobroma cacao</u>
			310	Cocoa green beans	
			311	Cocoa dry beans	
		d		Pasture	
3	food crops		400	ROOT CROPS	
		r	410	Sweet Potato	<u>Ipomoea batatas</u>
		s	411	Taro Common	<u>Colocasia esculenta</u>
		s	412	Giant	<u>Alocasia micorhiza</u>
		s	413	Hong Kong	<u>Xanthosoma saggitifolium</u>
		s	414	Swamp	<u>Cytosperma chamissonis</u>
		t	415	Yam	<u>Dioscorea alata</u>
		u	416	Pana	<u>Dioscorea esculenta</u>
		v	417	Cassava	<u>Manihot esculenta</u>
		w	419	Other root crop	
3	food crops	e	430	GRAIN CROPS	
			431	Corn	<u>Zea mays</u>
			432	Peanuts	<u>Arachis hypogaea</u>
			439	Other grain crop	
3	food crops	f	440	BEANS	
			441	Long bean	<u>Phaseolus vulgaris</u>
			442	Wing bean	<u>Psophocarpus tetragonolobus</u>
			443	Snake bean	<u>Trichosanthes cucumerina</u>
			444	Mung bean	<u>Phaseolus aureus</u>
			445	Pigeon pea	<u>Cajanus cajan</u>
			449	Other bean	

3	food crops	g	450	CABBAGE	
			451	Hibiscus cabbage	<u>Hibiscus manihot</u>
			452	Kangkong	
			453	Chinese cabbage	<u>Brassica chinensis</u>
			454	English cabbage	<u>Brassica conpestitis</u>
			455	Watercress	
3	food crops	h	459	Other cabbage	
			460	VEGETABLE	
			461	Pumpkin	<u>Cucurbita maxima</u>
			462	Cucumber	<u>Cucumis sativus</u>
			463	Shallot	<u>Allium spp.</u>
			464	Onion	<u>Allium cepa</u>
			465	Tomato	<u>Lycopersicon esculentum</u>
			466	Okra	<u>Hibiscus esculentus</u>
			467	Egg plant	<u>Solanum melongena</u>
			468	Green pepper (sweet)	<u>Capsicum annuum</u>
2	short term cash crops	i	479	Other vegetable	
			500	SPICES	
			511	Chilli pepper	<u>Capsicum spp.</u>
			512	Pepper corn	<u>Piper nigrum</u>
			513	Turmeric	<u>Curcuma domestica</u>
			514	Cardamom	<u>Ellettaria cardamomum</u>
			515	Cinnamon	<u>Cinnamomum zeylanicum</u>
			516	Ginger	<u>Zingiber officinale</u>
			517	Garlic	<u>Allium sativum</u>
			518	Vanilla	<u>Vanilla fragrans</u>
			529	Other spice	
2/3	cash/food crops	j	600	FRUIT CROPS	
			611	Water melon	<u>Citrullus lanatus</u>
			612	Rock melon	
			613	Pineapple	<u>Ananas comosus</u>
			614	Paw Paw	<u>Carica papaya</u>
			615	Passion fruit	<u>Passiflora edulus f. flavicarpa</u>
			619	Other fruit crop	
1	tree crops	k	620	FRUIT TREES	
			621	Guava	<u>Psidium guajava</u>
			622	Mango	<u>Mangifera indica</u>
			623	Soursop	
			624	Local Apple	
			625	Malayan Apple	<u>Eugenia malaccensis</u>
			626	Avocado	<u>Persea americana</u>
			629	Other fruit tree	

3	food crops	l	630 BANANA	<u>Musa spp.</u>
			631 Cooking banana	
			632 Sweet banana	
			639 Other banana	
1	tree crops	m	640 CITRUS TREES	
			641 Orange	<u>Citrus sinensis</u>
			642 Lime	<u>Citrus aurantifolia</u>
			643 Grapefruit	<u>Citrus paradisi</u>
			644 Pomelo	<u>Citrus grandis</u>
			649 Other citrus	
1	tree crops	n	650 NUT TREES	
			651 Ngali Nut	<u>Canarium spp.</u>
			652 Cut Nut	<u>Barringtonia spp.</u>
			653 Betel Nut	<u>Areca catechu</u>
			654 Cashew Nut	<u>Anacardium occidentale</u>
			655 Alite Nut	<u>Terminalia catappa</u>
			659 Other Nut	
2	short term cash crops	o	660 SUGAR CANE	
			661 Sugar cane	<u>Saccharum spp.</u>
			662 Pit Pit	<u>Saccharum edule</u>
			669 Other	
1	tree crops	p	700 FOOD/BUILDING TREE	
			701 Breadfruit	<u>Artocarpus altilis</u>
			702 Sago palm	<u>Metroxylon spp.</u>
			703 Bamboo	<u>Nastus spp.</u>
			709 Other tree	
2	short term cash crops	q	800 Tobacco	<u>Nicotiana tabacum</u>

## **Annex: 2**

### **LABOUR BUDGETS**

A2.1 Summmaries of labour in the main body of the report are derived from labour budgets shown in tables A2.1 to A2.9, each covering a major land or crop operation:

<u>Table</u>	<u>Operation</u>
A2.1	Land Clearance
A2.2	Cultivation
A2.3	Planting
A2.4	Tree Crops Establishment
A2.5	Tree Crops Maintenance
A2.6	First Weeding
A2.7	Second Weeding
A2.8	Third Weeding
A2.9	Harvesting

A2.2 Each table is divided into two sub-tables, named "a" and "b". Part "a" expresses budgets in the form of labour per hectare. Part "b" converts these results to labour per holding, based on mean holding sizes previously derived.

A2.3 Tables in "part a" are divided into two main components. Part "i" expresses "labour input by main crop growing in the plot". This is the measured labour input from field data and is derived from a subsample of plot observations. To the left of the table is the main crop type, which is the dominant crop in a mixture. In the first column of the table is the number of plots on which observations were made, and in the second column is the mean area of observed plots. The third column summarises the average number of times per year that the operation is performed in a cropping sequence, and the fourth column expresses the average number of hours worked per day.



A2.4 Within the box are labour data expressed in terms of seasonal (single crop) and annual (crop sequence) labour input, broken down by men, women and paid labour. The wage cost of paid labour is shown in the right-most column. In this, hours are converted to days by dividing by the average number of hours worked per day. This then takes account of "unproductive" time such as for travel to and from the garden, and expresses labour in terms of actual time taken. It does not, however, take account of different agricultural operations which may take place on the same day for instance where a morning might be spent clearing a plot while the afternoon is spent in weeding. Commonly work is split between the cool hours of the morning and late afternoon and so such circumstances should not generally arise.

A2.5 Below is "part ii" of the table, in which the composition of labour input is shown in more detail. The first four columns show the average number of workers in each category. Within the box is a summary of the table above, in which the % contribution of men, women and paid labour is shown.

A2.6 "Part b" of the table is on the page following "part a", in which annual labour per hectare is converted to annual labour per holding based on mean holding areas recorded for each given crop and operation - since each sub-sample will differ from the others. These are shown in the upper part of the table in two forms, as work hours and as work days by category of labour. The annual wage labour cost is shown in the far right column of the table.

A2.7 Below is the labour budget expressed in terms of time per household labour unit. In this it is assumed that communal labour is reciprocated and so balances out. Total labour input may therefore be expressed simply in terms of family labour. Wage labour is external and is therefore given the adult equivalent "weighting" of 1. Family labour is weighted according to the age composition of the family, analysed in chapter 3.

A2.8 Each set of tables for an operation is accompanied by a diagram in which the annual days of labour per holding are summarised by crop and by labour category.

A2.9 Various points should be noted about the derivation of labour budgets:

i) They are expressed in the form of "models" which are based on a sub-sample of observations. These are derived from interview, not direct measurement, although care is taken to minimise recall periods. Labour budgets are built up from a mosaic of labour records.

ii) Crop categories are summaries of complex mixtures in which the crop listed is dominant. Labour data are thus compatible with cropping pattern data and represents actual field conditions. No attempt is made to restrict or control the conditions under observation.

iii) Each table shows the labour input for an operation which is conducted. The tables do not show the extent to which operations may be missed or combined. Such refinements are difficult to include without a more complex, and therefore more costly and time consuming, survey design. The analysis therefore tends to be conservative since it does not take account of possible economies in combined operations.

iv) Caution should be exercised in interpreting results from few observations since labour data on complex systems are very variable.

v) Labour, although of central importance in the agricultural economy, is not necessarily economically optimising. Often labour has an important social character in which households will group together and "share" labour. Differences in site and labour composition, together with the social character of some labour, introduce considerable variability into results.

Table: A2.1

## LABOUR OPERATIONS ON LAND CLEARANCE (per hectare)

					<----- labour input ----->					labour
					<--- per season --->		<-- per year -->			cost
					<----- hours/ha ----->		hours		days	
					men	women	paid	(hrs/ha)	(d/ha)	(\$/ha/yr)
number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day							
i) Labour input by main crop growing in the plot										
All plots summary :	45	0.103	1.11	4.4	185	268	30	537	123	27.69
Cleared land a:	5	0.034	1.00	2.2	175	264	131	570	259	89.80
Cocoa c:	1	2.000	1.00	6.0	189	198		387	65	
Cabbage g:	1	0.090	1.00	6.0	133	133		266	44	
Vegetable h:	1	0.022	3.00	2.0	91	91		546	273	
Fruit crops j:	2	0.263	1.00	5.0			131	131	26	97.64
Sweet potato r:	24	0.056	1.04	4.7	199	320	17	558	119	12.87
Taro s:	2	0.027	1.00	2.0	188			188	94	
Yam t:	1	0.038	1.00	8.0		210		210	26	
Pana u:	6	0.055	1.00	5.8	221	309	6	536	92	48.84
Cassava v:	2	0.037	2.00	6.0	280	280		1120	187	

Note: 5 hours/day is an assumed figure for fruit crops

<- average number of workers ->					<-- % contribution -->		
men	women	paid	total		men	women	paid
ii) Labour composition							
All plots summary :	0.9	1.1	1.5	3.6	38	55	6
Cleared land a:	0.4	0.6	4.8	5.8	31	46	23
Cocoa c:	3.0	3.0		6.0	49	51	
Cabbage g:	1.0	1.0		2.0	50	50	
Vegetable h:	1.0	1.0		2.0	50	50	
Fruit crops j:			12.5	12.5			100
Sweet potato r:	0.9	1.3	0.8	2.9	37	60	3
Taro s:	1.0			1.0	100		
Yam t:		1.0		1.0		100	
Pana u:	1.3	1.7	0.2	3.2	41	58	1
Cassava v:	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON LAND CLEARANCE (per holding)

## i) Total time worked

		mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
			men	women	paid	men	women	paid	total	
Total	:	0.850	77	101	22	15	20	5	40	17
Cleared land	:	0.008	1	2	1	1	1	0	2	1
Cocoa	:	0.162	31	32		5	5		10	
Cabbage	:	0.003	0	0		0	0		0	
Vegetable	:	0.001	0	0		0	0		0	
Fruit crops	:	0.137			18			4	4	13
Sweet potato	:	0.167	35	56	3	7	12	1	20	2
Taro	:	0.007	1			1			1	
Yam	:	0.004		1			0		0	
Pana	:	0.018	4	6	0	1	1	0	2	1
Cassava	:	0.008	4	4		1	1		1	
Other		0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

		<----- work hours ----->			<----- work days ----->			% contribution to family labour	
		men	women	paid	men	women	paid	men	women
Labour units available		1.65	1.81	1.00					
Total		47	56	22	9	11	3	43	57
Cleared land		1	1	1	0	1	0	40	60
Cocoa		19	18		3	3		49	51
Cabbage		0	0		0	0		50	50
Vegetable		0	0		0	0		50	50
Fruit crops				18			2		
Sweet potato		21	31	3	4	7	0	38	62
Taro		1			0			100	
Yam			0			0			100
Pana		2	3	0	0	1	0	42	58
Cassava		3	2		0	0		50	50

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.2

## LABOUR OPERATIONS ON CULTIVATION (per hectare)

					<div> <div>&lt;----- labour input -----&gt;</div> <div> <div>&lt;--- per season ----&gt;</div> <div>&lt;--- per year --&gt;</div> <div>&lt;----- hours/ha -----&gt;</div> <div>hours</div> <div>days</div> <div>men</div> <div>women</div> <div>paid</div> <div>(hrs/ha)</div> <div>(d/ha)</div> <div>(\$/ha/yr)</div> </div> </div>						labour cost
	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day							
i) Labour input by main crop growing in the plot											
All plots summary :	39	0.062	1.28	4.8	269	193	9	604	127		13.21
Cleared land a:											
Cocoa c:											
Cabbage g:											
Vegetable h:	1	0.022	3.00	5.0	273	273		1638	328		
Fruit crops j:	2	0.263	1.00	5.5	99	27		126	23		
Sweet potato r:	26	0.055	1.27	4.5	286	233	13	675	149		19.82
Taro s:	1	0.010	1.00	4.0	421			421	105		
Yam t:	1	0.038	1.00	4.0	210			210	53		
Pana u:	6	0.055	1.00	6.0	259	159		418	70		
Cassava v:	2	0.037	2.00	3.5	200	80		560	160		
ii) Labour composition											
All plots summary :					57	41	2				
Cleared land a:											
Cocoa c:											
Cabbage g:											
Vegetable h:	1.0	1.0		2.0	50	50					
Fruit crops j:	1.0	0.5		1.5	79	21					
Sweet potato r:	1.6	0.7	0.2	2.5	54	44	2				
Taro s:	1.0			1.0	100						
Yam t:	1.0			1.0	100						
Pana u:	1.5	0.7		2.2	62	38					
Cassava v:	1.0	0.5		1.5	71	29					

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON CULTIVATION (per holding)

## i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 0.850	87	58	3	19	13	1	32	3
Cleared land	: 0.008								
Cocoa	: 0.162								
Cabbage	: 0.003								
Vegetable	: 0.001	1	1		0	0		0	
Fruit crops	: 0.137	14	4		2	1		3	
Sweet potato	: 0.167	61	49	3	13	11	1	25	3
Taro	: 0.007	3			1			1	
Yam	: 0.004	1			0			0	
Pana	: 0.018	5	3		1	0		1	
Cassava	: 0.008	3	1		1	0		1	
Other	0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.65	1.81	1.00					
Total	53	32	3	11	7	0	60	40
Cleared land								
Cocoa								
Cabbage								
Vegetable	0	0		0	0		50	50
Fruit crops	8	2		1	0		79	21
Sweet potato	37	27	3	8	6	0	55	45
Taro	2			0			100	
Yam	1			0			100	
Pana	3	2		0	0		62	38
Cassava	2	1		1	0		71	29

Derived from household composition labour availability

\* contribution to family labour is derived from the table above

Table: A2.3

## LABOUR OPERATIONS ON PLANTING (per hectare)

					<----- labour input ----->					labour
					<--- per season --->		<-- per year -->			cost
					<----- hours/ha ----->		hours	days		
					men	women	paid (hrs/ha)	(d/ha)	(\$/ha/yr)	
i) Labour input by main crop growing in the plot										
All plots summary	:	42	0.109	1.26	5.1	198	252	568	112	
Cleared land	a:									
Cocoa	c:	1	2.000	1.00	6.0	300		300	50	
Cabbage	g:	1	0.090	1.00	4.0		133	133	33	
Vegetable	h:	1	0.022	3.00	6.0	273	273	1638	273	
Fruit crops	j:	2	0.263	1.00	5.5	99	27	126	23	
Sweet potato	r:	26	0.055	1.27	5.1	176	351	669	131	
Taro	s:	2	0.027	1.00	3.0	299		299	100	
Yam	t:	1	0.038	1.00	4.0	210		210	53	
Pana	u:	6	0.055	1.00	6.0	359	99	458	76	
Cassava	v:	2	0.037	2.00	3.5		200	400	114	

<- average number of workers ->					<-- % contribution -->		
					men	women	paid
ii) Labour composition							
All plots summary	:	1.2	1.0	2.2	44	56	
Cleared land	a:						
Cocoa	c:	2.0		2.0	100		
Cabbage	g:		1.0	1.0		100	
Vegetable	h:	1.0	1.0	2.0	50	50	
Fruit crops	j:	1.0	0.5	1.5	79	21	
Sweet potato	r:	0.9	1.3	2.2	33	67	
Taro	s:	1.0		1.0	100		
Yam	t:	1.0		1.0	100		
Pana	u:	3.2	0.5	3.7	78	22	
Cassava	v:		1.0	1.0		100	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.

2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON PLANTING (per holding)

## i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 0.850	110	84		20	17		37	
Cleared land	: 0.008								
Cocoa	: 0.162	49			8			8	
Cabbage	: 0.003		0			0		0	
Vegetable	: 0.001	1	1		0	0		0	
Fruit crops	: 0.137	14	4		2	1		3	
Sweet potato	: 0.167	37	74		7	15		22	
Taro	: 0.007	2			1			1	
Yam	: 0.004	1			0			0	
Pana	: 0.018	6	2		1	0		1	
Cassava	: 0.008		3			1		1	
Other	0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.65	1.81	1.00					
Total	66	47		12	9		57	43
Cleared land								
Cocoa	29			5			100	
Cabbage		0			0			100
Vegetable	0	0		0	0		50	50
Fruit crops	8	2		1	0		79	21
Sweet potato	23	41		4	8		33	67
Taro	1			0			100	
Yam	1			0			100	
Pana	4	1		1	0		78	22
Cassava		2			1			100

Derived from household composition labour availability

% contribution to family labour is derived from the table above



Table: A2.4

## LABOUR OPERATIONS ON ESTABLISHMENT (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	<----- labour input -----> <--- per season ---> <-- per year --> <----- hours/ha ----->    hours    days men    women    paid (hrs/ha)    (d/ha) (\$/ha/yr)
--	--------------------------------	------------------------------	-----------------------------------	---------------------------------------	--

i) Labour input by main crop growing in the plot

All plots summary :

Cleared land	a:
Cocoa	c:
Cabbage	g:
Vegetable	h:
Fruit crops	j:
Sweet potato	r:
Taro	s:
Yam	t:
Pana	u:
Cassava	v:

<- average number of workers ->			
men	women	paid	total

<-- % contribution -->		
men	women	paid

ii) Labour composition

All plots summary :

Cleared land	a:
Cocoa	c:
Cabbage	g:
Vegetable	h:
Fruit crops	j:
Sweet potato	r:
Taro	s:
Yam	t:
Pana	u:
Cassava	v:

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON ESTABLISHMENT (per holding)

## i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SI\$)
		men	women	paid	men	women	paid	total	
Total	: 0.850								
Cleared land	: 0.008								
Cocoa	: 0.162								
Cabbage	: 0.003								
Vegetable	: 0.001								
Fruit crops	: 0.137								
Sweet potato	: 0.167								
Taro	: 0.007								
Yam	: 0.004								
Pana	: 0.018								
Cassava	: 0.008								
Other	0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.65	1.81	1.00					
Total								
Cleared land								
Cocoa								
Cabbage								
Vegetable								
Fruit crops								
Sweet potato								
Taro								
Yam								
Pana								
Cassava								

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.5

## LABOUR OPERATIONS ON MAINTENANCE (per hectare)

						<----- labour input ----->						labour
						<--- per season --->			<-- per year -->			cost
						<----- hours/ha ----->			hours	days		
						men	women	paid	(hrs/ha)	(d/ha)		(\$/ha/yr)
i) Labour input by main crop growing in the plot												
All plots summary	:	8	0.253	1.50	2.5	25	47	22	143	57		48.50
Cleared land	a:											
Cocoa	c:	4	0.200	1.25	3.0	16	39	20	94	31		35.47
Cabbage	g:											
Vegetable	h:											
Fruit crops	j:	4	0.306	1.75	2.0	35	55	25	201	100		61.53
Sweet potato	r:											
Taro	s:											
Yam	t:											
Pana	u:											
Cassava	v:											

						<- average number of workers ->			<-- % contribution -->			
						men	women	paid	total	men	women	paid
ii) Labour composition												
All plots summary	:	0.5	0.4	4.4	5.3	27	50	23				
Cleared land	a:											
Cocoa	c:	0.3	0.3	5.3	5.8	21	52	27				
Cabbage	g:											
Vegetable	h:											
Fruit crops	j:	0.8	0.5	3.5	4.8	30	48	21				
Sweet potato	r:											
Taro	s:											
Yam	t:											
Pana	u:											
Cassava	v:											

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON MAINTENANCE (per holding)

## i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 0.850	12	21	10	5	9	4	19	14
Cleared land	: 0.008								
Cocoa	: 0.162	3	8	4	1	3	1	5	6
Cabbage	: 0.003								
Vegetable	: 0.001								
Fruit crops	: 0.137	8	13	6	4	7	3	14	8
Sweet potato	: 0.167								
Taro	: 0.007								
Yam	: 0.004								
Pana	: 0.018								
Cassava	: 0.008								
Other	0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.65	1.31	1.00					
Total	7	12	10	3	5	2	35	65
Cleared land								
Cocoa	2	4	4	1	1	1	29	71
Cabbage								
Vegetable								
Fruit crops	5	7	6	3	4	2	39	61
Sweet potato								
Taro								
Yam								
Pana								
Cassava								

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.6

## LABOUR OPERATIONS ON FIRST WEEDING (per hectare)

					<----- labour input ----->						labour
					<--- per season ---->		<-- per year -->				cost
					<---- hours/ha ---->		hours	days			
					men	women	paid	(hrs/ha)	(d/ha)	(\$/ha/yr)	
i) Labour input by main crop growing in the plot											
All plots summary	:	37	0.138	1.30	5.2	35	290	1	422	81	0.96
Cleared land	a:										
Cocoa	c:	2	1.281	1.00	7.0	19	5		23	3	
Cabbage	g:	1	0.090	1.00	3.0		199		199	66	
Vegetable	h:										
Fruit crops	j:	2	0.433	2.50	6.0	65	36		253	42	
Sweet potato	r:	21	0.052	1.29	5.3	33	384		536	101	
Taro	s:	2	0.035	1.00	3.5	81	214		295	84	
Yam	t:	1	0.038	1.00	6.0		158		158	26	
Pana	u:	6	0.050	1.00	5.3	46	192	5	242	45	6.90
Cassava	v:	2	0.037	2.00	4.0		281		562	141	

<- average number of workers ->					<-- % contribution -->			
					men	women	paid	
ii) Labour composition								
All plots summary	:	0.4	1.3	0.1	1.7	11	89	0
Cleared land	a:							
Cocoa	c:	2.0	1.5		3.5	81	19	
Cabbage	g:		2.0		2.0		100	
Vegetable	h:							
Fruit crops	j:	1.0	1.0		2.0	64	36	
Sweet potato	r:	0.2	1.2		1.5	8	92	
Taro	s:	0.5	1.5		2.0	28	72	
Yam	t:		1.0		1.0		100	
Pana	u:	0.3	1.5	0.3	2.2	19	79	2
Cassava	v:		1.0		1.0		100	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON FIRST WEEDING (per holding)

## i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 0.850	34	106	0	6	20	0	26	0
Cleared land	: 0.008								
Cocoa	: 0.162	3	1		0	0		1	
Cabbage	: 0.003		1			0		0	
Vegetable	: 0.001								
Fruit crops	: 0.137	22	12		4	2		6	
Sweet potato	: 0.167	7	32		1	16		17	
Taro	: 0.007	1	1		0	0		1	
Yam	: 0.004		1			0		0	
Pana	: 0.018	1	3	0	0	1	0	1	0
Cassava	: 0.008		4			1		1	
Other	0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.65	1.81	1.00					
Total	20	59	0	4	11	0	24	76
Cleared land								
Cocoa	2	0		0	0		81	19
Cabbage		0			0			100
Vegetable								
Fruit crops	14	7		2	1		64	36
Sweet potato	4	46		1	9		8	92
Taro	0	1		0	0		28	72
Yam		0			0			100
Pana	0	2	0	0	0	0	19	81
Cassava		2			1			100

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.7

## LABOUR OPERATIONS ON SECOND WEEDING (per hectare)

					labour input ----->					labour
					<--- per season ---->		<-- per year -->			cost
					<---- hours/ha ---->		hours	days		
number	of	mean	operation	average	men	women	paid	(hrs/ha)	(d/ha)	(\$/ha/yr)
obs	plot	area	times	hours						
(plots)	(ha)	year	per	worked						
			year	per day						
i) Labour input by main crop growing in the plot										
All plots summary	:	11	0.349	1.45	5.6	30	281	452	80	
Cleared land	a:									
Cocoa	c:	2	1.281	1.00	7.0	19	5	23	3	
Cabbage	g:									
Vegetable	h:									
Fruit crops	j:	2	0.433	2.50	6.0	65	36	254	42	
Sweet potato	r:	6	0.064	1.33	5.3		474	632	119	
Taro	s:	1	0.025	1.00	4.0	163	163	325	81	
Yam	t:									
Pana	u:									
Cassava	v:									
ii) Labour composition										
All plots summary	:	0.6	1.1	1.7	10	90				
Cleared land	a:									
Cocoa	c:	2.0	1.5	3.5	81	19				
Cabbage	g:									
Vegetable	h:									
Fruit crops	j:	1.0	1.0	2.0	64	36				
Sweet potato	r:		1.0	1.0		100				
Taro	s:	1.0	1.0	2.0	50	50				
Yam	t:									
Pana	u:									
Cassava	v:									

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
 2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON SECOND WEEDING (per holding)

## i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (SIS)
		men	women	paid	men	women	paid	total	
Total	: 0.850	27	120		4	22		27	
Cleared land	: 0.008								
Cocoa	: 0.162	3	1		0	0		1	
Cabbage	: 0.003								
Vegetable	: 0.001								
Fruit crops	: 0.137	22	12		4	2		6	
Sweet potato	: 0.167		106			20		20	
Taro	: 0.007	1	1		0	0		1	
Yam	: 0.004								
Pana	: 0.018								
Cassava	: 0.008								
Other	0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.65	1.81	1.00					
Total	16	66		3	12		18	82
Cleared land								
Cocoa	2	0		0	0		81	19
Cabbage								
Vegetable								
Fruit crops	14	7		2	1		64	36
Sweet potato		58			11			100
Taro	1	1		0	0		50	50
Yam								
Pana								
Cassava								

Derived from household composition labour availability

% contribution to family labour is derived from the table above



Table: A2.8

## LABOUR OPERATIONS ON THIRD WEEDING (per hectare)

					<----- labour input ----->					labour
					<--- per season --->		<-- per year -->			cost
					<--- hours/ha --->		hours	days		
					men	women	paid (hrs/ha)	(d/ha)	(\$/ha/yr)	
i) Labour input by main crop growing in the plot										
All plots summary	:	2	0.224	2.50	4.0	128	81	523	131	
Cleared land	a:									
Cocoa	c:									
Cabbage	g:									
Vegetable	h:									
Fruit crops	j:	1	0.424	4.00	4.0	94		376	94	
Sweet potato	r:									
Taro	s:	1	0.025	1.00	4.0	163	163	326	82	
Yam	t:									
Pana	u:									
Cassava	v:									
ii) Labour composition										
<- average number of workers ->					<-- % contribution -->					
men women paid total					men women paid					
All plots summary	:	1.0	0.5	1.5	61	39				
Cleared land	a:									
Cocoa	c:									
Cabbage	g:									
Vegetable	h:									
Fruit crops	j:	1.0		1.0	100					
Sweet potato	r:									
Taro	s:	1.0	1.0	2.0	50	50				
Yam	t:									
Pana	u:									
Cassava	v:									

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON THIRD WEEDING (per holding)

## i) Total time worked

	mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (\$/S)
		men	women	paid	men	women	paid	total	
Total	: 0.850	53	1		13	0		13	
Cleared land	: 0.008								
Cocoa	: 0.162								
Cabbage	: 0.003								
Vegetable	: 0.001								
Fruit crops	: 0.137	52			13			13	
Sweet potato	: 0.167								
Taro	: 0.007	1	1		0	0		1	
Yam	: 0.004								
Pana	: 0.018								
Cassava	: 0.008								
Other	0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

	<----- work hours ----->			<----- work days ----->			% contribution to family labour	
	men	women	paid	men	women	paid	men	women
Labour units available	1.65	1.81	1.00					
Total	32	1		8	0		98	2
Cleared land								
Cocoa								
Cabbage								
Vegetable								
Fruit crops	31			8			100	
Sweet potato								
Taro	1	1		0	0		50	50
Yam								
Pana								
Cassava								

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.9

## LABOUR OPERATIONS ON HARVESTING (per hectare)

					<div> <div>----- labour input -----</div> <div> <div>&lt;--- per season ---&gt;</div> <div>&lt;--- per year ---&gt;</div> <div>&lt;--- hours/ha ---&gt;</div> <div>men</div> <div>women</div> <div>paid</div> <div>(hrs/ha)</div> <div>(d/ha)</div> <div>(\$/ha/yr)</div> </div> </div>					labour cost
number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day							
i) Labour input by main crop growing in the plot										
All plots summary :	31	0.201	2.26	2.5	30	792		1856	757	
Cleared land a:										
Cocoa c:	2	1.281	12.50	5.0	13	9		270	54	
Cabbage g:	1	0.090	1.00	1.0		166		166	166	
Vegetable h:										
Fruit crops j:	6	0.294	1.00	4.0	153	558		711	178	
Sweet potato r:	20	0.089	1.80	1.9		911		1640	863	
Taro s:	1	0.025	1.00	2.0		1951		1951	976	
Yam t:										
Pana u:										
Cassava v:	1	0.025	1.00	1.0		837		837	837	
ii) Labour composition										
All plots summary :	0.4	1.3		1.7	4	96				
Cleared land a:										
Cocoa c:	2.0	1.5		3.5	58	42				
Cabbage g:		1.0		1.0		100				
Vegetable h:										
Fruit crops j:	1.3	1.2		2.5	22	78				
Sweet potato r:		1.4		1.4		100				
Taro s:		1.0		1.0		100				
Yam t:										
Pana u:										
Cassava v:		1.0		1.0		100				

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.  
2. "Hours per year" is the sum of hours per season multiplied by times per year.

# LABOUR OPERATIONS ON HARVESTING (per holding)

## i) Total time worked

		mean holding area (ha)	<----- work hours ----->			<----- work days ----->				labour cost (\$)
			men	women	paid	men	women	paid	total	
Total	:	0.850	46	389		10	181		191	
Cleared land	:	0.008								
Cocoa	:	0.162	25	18		5	4		9	
Cabbage	:	0.003		0			0		0	
Vegetable	:	0.001								
Fruit crops	:	0.137	21	76		5	19		24	
Sweet potato	:	0.167		274			144		144	
Taro	:	0.007		14			7		7	
Yam	:	0.004								
Pana	:	0.018								
Cassava	:	0.008		7			7		7	
Other		0.335								

Derived from plot details aggregated over entire holding

## ii) Time worked per labour unit

		<----- work hours ----->			<----- work days ----->			% contribution to family labour	
		men	women	paid	men	women	paid	men	women
Labour units available		1.65	1.81	1.00					
Total		28	215		6	100		11	89
Cleared land									
Cocoa		15	10		3	2		58	42
Cabbage			0			0			100
Vegetable									
Fruit crops		13	42		3	11		22	78
Sweet potato			151			80			100
Taro			8			4			100
Yam									
Pana									
Cassava			4			4			100

Derived from household composition labour availability

\* contribution to family labour is derived from the table above

## LAND CLEARANCE

### Annual Labour per Holding

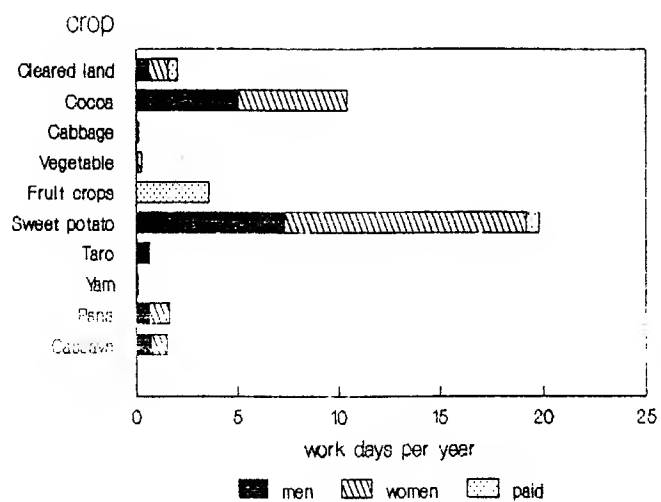


Diagram: A2.1

## CULTIVATION

### Annual Labour per Holding

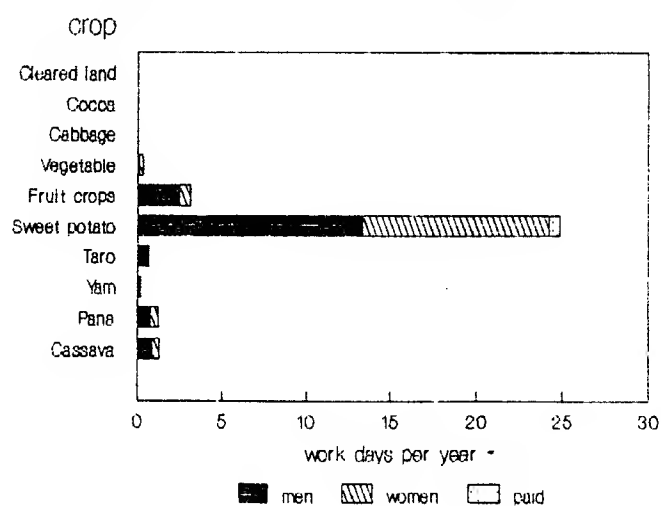


Diagram: A2.2

## PLANTING Annual Labour per Holding

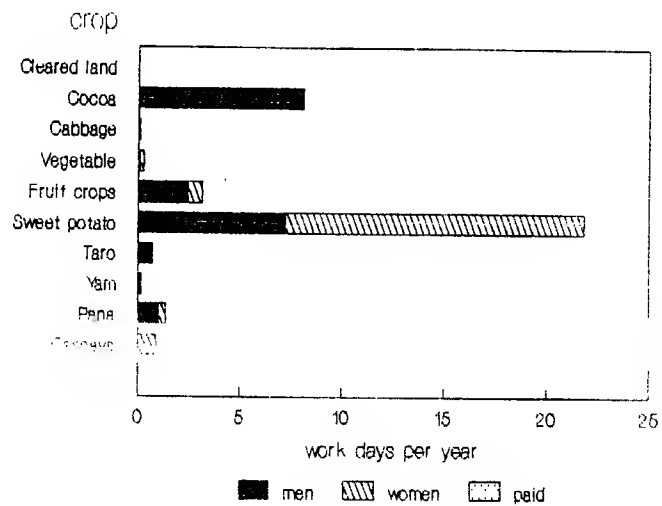


Diagram: A2.3

## CROPS ESTABLISHMENT Annual Labour per Holding

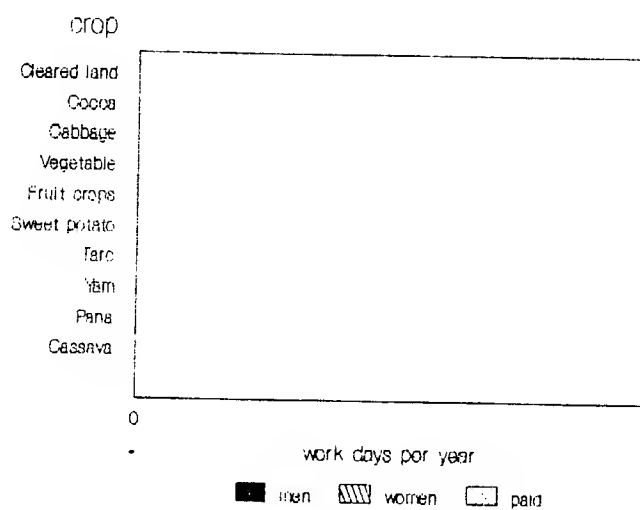


Diagram: A2.4

## CROPS MAINTENANCE

### Annual Labour per Holding

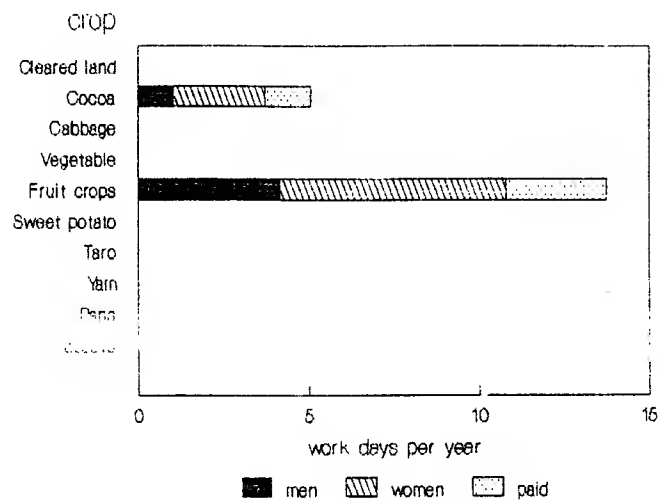


Diagram: A2.5

## FIRST WEEDING

### Annual Labour per Holding

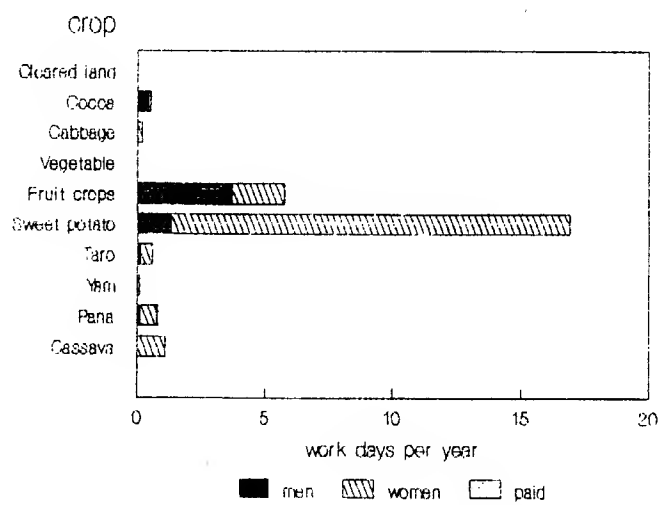


Diagram: A2.6

## SECOND WEEDING

### Annual Labour per Holding

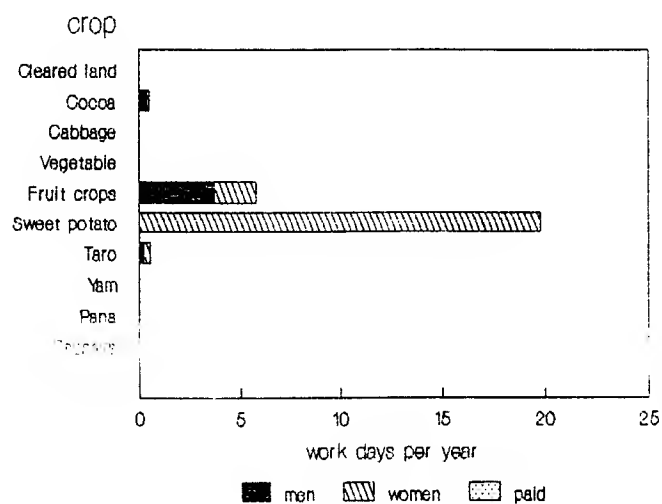


Diagram: A2.7

## THIRD WEEDING

### Annual Labour per Holding

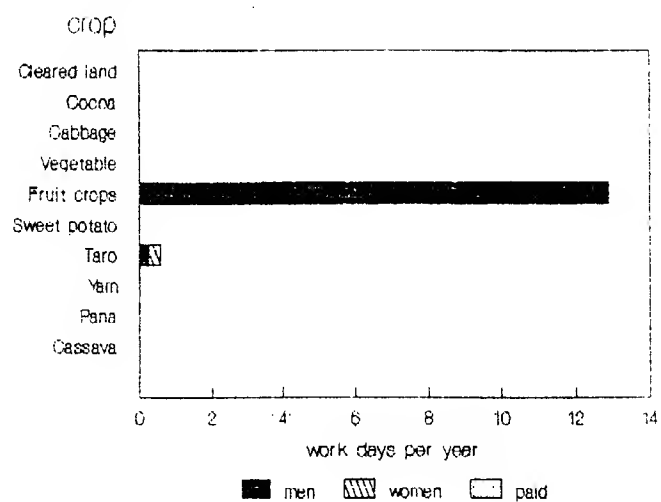


Diagram: A2.8



# HARVESTING

## Annual Labour per Holding

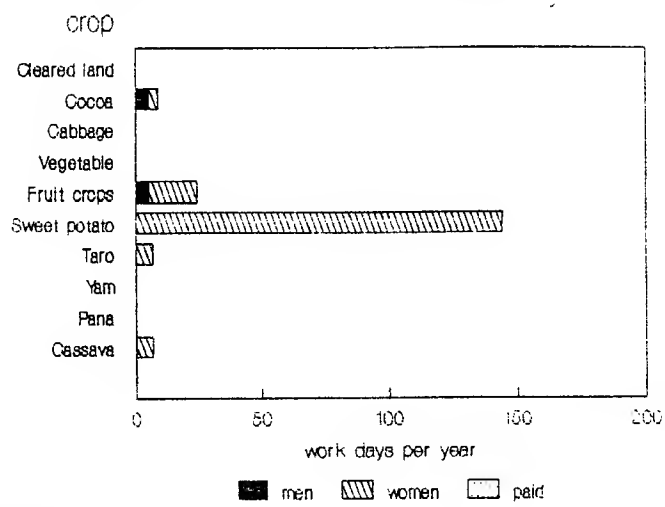


Diagram A2.9

**Annex: 3**  
**CROP DAMAGE**

A3.1 The following analysis of crop damage is based on observations of crop mixtures at the plot level. Tables show the dominant crop growing in the mixture, but damage encountered may refer to other crops in the plot. In the present analysis it is possible only to present results at the plot level, and not at the crop level.

Table: A3.1a  
CROP DAMAGE DUE TO INSECTS - AFFECTING LEAVES

i) Frequency of plots damaged

extent of damage:	little	considerable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots	13	8	2	I		120	19	81
cleared land	a				I	6		100
coconut	b				I	5		100
cocoa	c	1			I	8	13	88
coconut + cocoa	z				I	6		100
cabbage	g				I	1		100
vegetable	h				I	1		100
fruit crops	j				I	13		100
sweet potato	r	7	4	2	I	58	22	78
taro	s	2	2		I	6	67	33
yam	t				I	2		100
pana	u	2	2		I	10	40	60
cassava	v	1			I	4	25	75

ii) % crop area affected

extent of damage:	little	considerable	severe	crop devastated	I	% affected	% unaffected
% total cropped area	10				I	10	90
cleared land	a				I		100
coconut	b				I		100
cocoa	c	25			I	25	75
coconut + cocoa	z				I		100
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r	25			I	25	75
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.1b  
CROP DAMAGE DUE TO INSECTS - AFFECTING FRUITS

i) Frequency of plots damaged

extent of damage:	little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots	12	9	2	I	120	19	81
cleared land	a			I	6		100
coconut	b	1		I	5	20	80
cocoa	c	2		I	8	38	63
coconut + cocoa	z	1		I	6	17	83
cabbage	g			I	1		100
vegetable	h			I	1		100
fruit crops	j	3	2	I	13	54	46
sweet potato	r	2		I	58	17	83
taro	s			I	6		100
yam	t			I	2		100
pana	u	1		I	10	10	90
cassava	v			I	4		100

ii) % crop area affected

extent of damage:	little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area	5	19	5	I	29	71
cleared land	a			I		100
coconut	b	17		I	17	83
cocoa	c	25		I	25	75
coconut + cocoa	z	33		I	33	67
cabbage	g			I		100
vegetable	h			I		100
fruit crops	j	25	25	I	50	50
sweet potato	r	25		I	25	75
taro	s			I		100
yam	t			I		100
pana	u			I		100
cassava	v			I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.1c

## CROP DAMAGE DUE TO INSECTS - AFFECTING ROOTS

## i) Frequency of plots damaged

extent of damage:	little	considerable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		3	1	I		120	3	97
cleared land	a				I	6		100
coconut	b				I	5		100
cocoa	c				I	8		100
coconut + cocoa	z				I	6		100
cabbage	g				I	1		100
vegetable	h				I	1		100
fruit crops	j	2			I	13	15	85
sweet potato	r		1		I	58	2	98
taro	s	1			I	6	17	83
yam	t				I	2		100
pana	u				I	10		100
cassava	v				I	4		100

## ii) % crop area affected

extent of damage:	little	considerable	severe	crop devastated	I	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
coconut + cocoa	z				I		100
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2a  
CROP DAMAGE DUE TO DISEASE - AFFECTING LEAVES

i) Frequency of plots damaged

extent of damage:	little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots	12	3	2	I	120	14	86
cleared land	a			I	6		100
coconut	b			I	5		100
cocoa	c	1		I	8	13	88
coconut + cocoa	z			I	6		100
cabbage	g	1		I	1	100	
vegetable	h			I	1		100
fruit crops	j			I	13		100
sweet potato	r	6	1	I	58	14	86
taro	s		2	I	6	50	50
yam	t			I	2		100
pana	u	3		I	10	30	70
cassava	v	1		I	4	25	75

ii) % crop area affected

extent of damage:	little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area	10			I	10	90
cleared land	a			I		100
coconut	b			I		100
cocoa	c	25		I	25	75
coconut + cocoa	z			I		100
cabbage	g			I		100
vegetable	h			I		100
fruit crops	j			I		100
sweet potato	r	25		I	25	75
taro	s			I		100
yam	t			I		100
pana	u			I		100
cassava	v			I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2a  
CROP DAMAGE DUE TO DISEASE - AFFECTING FRUITS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots		6	6		I	120	10	90
cleared land	a				I	6		100
coconut	b				I	5		100
cocoa	c	1	2		I	8	38	63
coconut + cocoa	z		1		I	6	17	83
cabbage	g	1			I	1	100	
vegetable	h				I	1		100
fruit crops	j				I	13		100
sweet potato	r	3	3		I	58	10	90
taro	s				I	6		100
yam	t				I	2		100
pana	u	1			I	10	10	90
cassava	v				I	4		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area			10		I	10	90
cleared land	a				I		100
coconut	b				I		100
cocoa	c		25		I	25	75
coconut + cocoa	z		33		I	33	67
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2c  
CROP DAMAGE DUE TO DISEASE - AFFECTING ROOTS

i) Frequency of plots damaged

extent of damage:	little	considerable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		1	1	I		120	2	98
cleared land	a			I		6		100
coconut	b			I		5		100
cocoa	c			I		8		100
coconut + cocoa	z			I		6		100
cabbage	g			I		1		100
vegetable	h			I		1		100
fruit crops	j			I		13		100
sweet potato	r			I		58		100
taro	s	1	1	I		6	33	67
yam	t			I		2		100
pana	u			I		10		100
cassava	v			I		4		100

ii) % crop area affected

extent of damage:	little	considerable	severe	crop devastated	I	% affected	% unaffected
% total cropped area					I		100
cleared land	a			I			100
coconut	b			I			100
cocoa	c			I			100
coconut + cocoa	z			I			100
cabbage	g			I			100
vegetable	h			I			100
fruit crops	j			I			100
sweet potato	r			I			100
taro	s			I			100
yam	t			I			100
pana	u			I			100
cassava	v			I			100

Note: The table of % area is only approximate due to rounding small numbers



Table: A3.3  
CROP DAMAGE DUE TO HUMANS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots					I	120		100
cleared land	a				I	6		100
coconut	b				I	5		100
cocoa	c				I	8		100
coconut + cocoa	z				I	6		100
cabbage	g				I	1		100
vegetable	h				I	1		100
fruit crops	j				I	13		100
sweet potato	r				I	58		100
taro	s				I	6		100
yam	t				I	2		100
pana	u				I	10		100
cassava	v				I	4		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
coconut + cocoa	z				I		100
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.4  
CROP DAMAGE DUE TO FIRE

i) Frequency of plots damaged

extent of damage:	little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots				I	120		100
cleared land	a			I	6		100
coconut	b			I	5		100
cocoa	c			I	8		100
coconut + cocoa	z			I	6		100
cabbage	g			I	1		100
vegetable	h			I	1		100
fruit crops	j			I	13		100
sweet potato	r			I	58		100
taro	s			I	6		100
yam	t			I	2		100
pana	u			I	10		100
cassava	v			I	4		100

ii) % crop area affected

extent of damage:	little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area				I		100
cleared land	a			I		100
coconut	b			I		100
cocoa	c			I		100
coconut + cocoa	z			I		100
cabbage	g			I		100
vegetable	h			I		100
fruit crops	j			I		100
sweet potato	r			I		100
taro	s			I		100
yam	t			I		100
pana	u			I		100
cassava	v			I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.5  
CROP DAMAGE DUE TO FLOOD

i) Frequency of plots damaged

extent of damage:	little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots			3	I	120	3	98
cleared land	a			I	6		100
coconut	b		1	I	5	20	80
cocoa	c			I	8		100
coconut + cocoa	z			I	6		100
cabbage	g			I	1		100
vegetable	h			I	1		100
fruit crops	j			I	13		100
sweet potato	r		2	I	58	3	97
taro	s			I	6		100
yam	t			I	2		100
pana	u			I	10		100
cassava	v			I	4		100

ii) % crop area affected

extent of damage:	little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area				I		100
cleared land	a			I		100
coconut	b			I		100
cocoa	c			I		100
coconut + cocoa	z			I		100
cabbage	g			I		100
vegetable	h			I		100
fruit crops	j			I		100
sweet potato	r			I		100
taro	s			I		100
yam	t			I		100
pana	u			I		100
cassava	v			I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.6  
CROP DAMAGE DUE TO WIND

i) Frequency of plots damaged

extent of damage:	little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		3	2	I		120	4	96
cleared land	a			I		6		100
coconut	b	1	2	I		5	60	40
cocoa	c	1		I		8	13	88
coconut + cocoa	z	1		I		6	17	83
cabbage	g			I		1		100
vegetable	h			I		1		100
fruit crops	j			I		13		100
sweet potato	r			I		58		100
taro	s			I		6		100
yam	t			I		2		100
pana	u			I		10		100
cassava	v			I		4		100

ii) % crop area affected

extent of damage:	little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area		10	14	I		24	76
cleared land	a			I			100
coconut	b	33	50	I		83	17
cocoa	c			I			100
coconut + cocoa	z			I			100
cabbage	g			I			100
vegetable	h			I			100
fruit crops	j			I			100
sweet potato	r			I			100
taro	s			I			100
yam	t			I			100
pana	u			I			100
cassava	v			I			100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.7  
CROP DAMAGE DUE TO RATS

i) Frequency of plots damaged

extent of damage:	little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots	12	32	4	I		120	40	60
cleared land	a				I	6		100
coconut	b	2			I	5	40	60
cocoa	c	3			I	8	38	63
coconut + cocoa	z	1			I	6	17	83
cabbage	g				I	1		100
vegetable	h				I	1		100
fruit crops	j	4	3		I	13	62	38
sweet potato	r	10	1		I	58	57	43
taro	s				I	6		100
yam	t				I	2		100
pana	u	1			I	10	10	90
cassava	v				I	4		100

ii) % crop area affected

extent of damage:	little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area	5	33	5	I		43	57
cleared land	a				I		100
coconut	b	17			I	17	83
cocoa	c	75			I	75	25
coconut + cocoa	z	33			I	33	67
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j	25	25		I	50	50
sweet potato	r	25			I	50	50
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.8  
CROP DAMAGE DUE TO BIRDS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots		3	8			I	120	9	91
cleared land	a					I	6		100
coconut	b					I	5		100
cocoa	c		2			I	8	25	75
coconut + cocoa	z		1			I	6	17	83
cabbage	g					I	1		100
vegetable	h					I	1		100
fruit crops	j	1	4			I	13	38	62
sweet potato	r	2	1			I	58	5	95
taro	s					I	6		100
yam	t					I	2		100
pana	u					I	10		100
cassava	v					I	4		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop devastated	I	% affected	% unaffected
% total cropped area			24			I	24	76
cleared land	a					I		100
coconut	b					I		100
cocoa	c		75			I	75	25
coconut + cocoa	z		33			I	33	67
cabbage	g					I		100
vegetable	h					I		100
fruit crops	j		25			I	25	75
sweet potato	r					I		100
taro	s					I		100
yam	t					I		100
pana	u					I		100
cassava	v					I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.9  
CROP DAMAGE DUE TO BATS

i) Frequency of plots damaged

extent of damage:		little	consid- erable	severe	crop I devastatedI	total # plots	% affected	% unaffected
all plots					I	120		100
cleared land	a				I	6		100
coconut	b				I	5		100
cocoa	c				I	8		100
coconut + cocoa	z				I	6		100
cabbage	g				I	1		100
vegetable	h				I	1		100
fruit crops	j				I	13		100
sweet potato	r				I	58		100
taro	s				I	6		100
yam	t				I	2		100
pana	u				I	10		100
cassava	v				I	4		100

ii) % crop area affected

extent of damage:		little	consid- erable	severe	crop I devastatedI	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
coconut + cocoa	z				I		100
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.10  
CROP DAMAGE DUE TO LIVESTOCK

i) Frequency of plots damaged

extent of damage:	little	considerable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots	1	2			I	120	3	98
cleared land	a				I	6		100
coconut	b				I	5		100
cocoa	c				I	8		100
coconut + cocoa	z				I	6		100
cabbage	g				I	1		100
vegetable	h				I	1		100
fruit crops	j	1			I	13	8	92
sweet potato	r		2		I	58	3	97
taro	s				I	6		100
yam	t				I	2		100
pana	u				I	10		100
cassava	v				I	4		100

ii) % crop area affected

extent of damage:	little	considerable	severe	crop devastated	I	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
coconut + cocoa	z				I		100
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers



Table: A3.11  
CROP DAMAGE DUE TO OTHER FACTORS

i) Frequency of plots damaged

extent of damage:	little	considerable	severe	crop devastated	I	total # plots	% affected	% unaffected
all plots	1	4	1	I		120	5	95
cleared land	a				I	6		100
coconut	b				I	5		100
cocoa	c				I	8		100
coconut + cocoa	z				I	6		100
cabbage	g				I	1		100
vegetable	h				I	1		100
fruit crops	j				I	13		100
sweet potato	r	1	4	1	I	58	10	90
taro	s				I	6		100
yam	t				I	2		100
pana	u				I	10		100
cassava	v				I	4		100

Note: "Other" damage is crabs and frogs

ii) % crop area affected

extent of damage:	little	considerable	severe	crop devastated	I	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
coconut + cocoa	z				I		100
cabbage	g				I		100
vegetable	h				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

**Annex: 4**  
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